Geography of

NORTH AMERICA

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THIRD EDITION

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PREFACE

To the Third Edition

In a comparatively short period of time white man has moved into and taken possession of North America. In his endeavor to satisfy his wants he has striven to make the most effective use of his resources, chief among which are those of the natural setting in which he is placed. In his occupancy of the land he has been guided, consciously or unconsciously, by his human desires and the natural conditions. His occupancy of the continent and his utilization of the natural resources available to him are the central theme of this book. What are the natural assets of the land he has occupied? What use has he made of those assets? What opportunities are still available to him? What are some of the social, political, and economic outcomes of his endeavor to utilize his resources and attain a higher standard of material well-being? These are but a few of many questions that may properly arise. Such a study involves consideration of physical features such as climate, relief, soils, minerals, etc., and native plant and animal life as elements of the natural environment. We believe that these features should receive sufficient consideration in a textbook to enable the student to evaluate their relationship to the cultural landscape. Some students have a tendency either to forget the earth upon which man lives in their enthusiasm to describe what man does, or forget man in their enthusiasm to describe the natural landscape.

Types of "geographical regions" appear to be about as numerous as authors, and most of such regions are little used by the average citizen. As an outgrowth of many years of class work with hundreds of beginning students we have found the units used in this book convenient for an introductory study. They are regions in common use, and hence of particular significance, since the great majority of students will study the geography of North America as a part of their training in general education. Only a few will become specialists in the geographic field, and to such students the book will serve as an introductory course. Since the book is designed as a basic textbook—not a treatise—it has been our purpose to present only the more general and basic materials, leaving the more detailed presentation and study to the instructor and student. It may be considered as the starting point for a study of the continent.

The usual statistical appendix has been omitted, since such material is readily obtainable from government and other sources. Furthermore, students should receive training in the use of original source material. As an aid in starting a working library we recommend the accompanying selected list of references. We follow the practice of assigning all these references and expect them to have been studied by the time the course is completed.

We wish to acknowledge our indebtedness to many individuals and government bureaus whose work has been drawn upon freely in the preparation of this book. Without the splendid work of the late Dr. O. E. Baker and his colleagues, the discussion of agriculture in the United States would be inadequate indeed. Other specific acknowledgments are made throughout.

We are also especially indebted to various departments of the Canadian Government, particularly the Bureau of Statistics, which has supplied a large amount of material, maps, and diagrams; to Dr. R. L. Gentilcore who read all the manuscript on Canada and contributed constructive criticism in the preparation of numerous maps; to Dr. Erwin Raisz and to Dr. A. K. Lobeck for permission to use the physiographic maps of Alaska and of North America. We also owe much to many who have used the second edition in their college classes and who have aided by giving constructive suggestions; also to many of our students who have contributed to this edition by selecting parts of the text not clear to them and suggesting what was needed. Further criticisms and suggestions are invited.

GEORGE J. MILLER
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March, 1954

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PART I

North America—The Continent

CHAPTER I

The Continent and Man

In examining a continent the geographer is concerned with a description of its major natural features and with its present and potential value to man. The natural features provide the setting, but man decides what will be done in that setting. In other words, the natural setting does not determine what man *will* do but places limits on what he *may* do, as his technical knowledge evolves. We must, therefore, consider both the geographical environment of man and man himself. His decisions may bring economic prosperity and happiness, or he may destroy the natural resources available to him, and may even destroy himself and the society of which he is a part.

The fitness of a continent or a region as a home for man may be measured by the number of people it can support and, if it has long been occupied, by the number it does sustain. The number it is sustaining can readily be determined by a census. But to determine the ultimate possible population with any degree of certainty is a difficult, if not an impossible, task because of the many factors involved. Besides, many of these factors are variable.

Since no continent is, at present, supporting all the people it can, that is, since no continent has reached the saturation point, a time factor is involved, and time in the future. Since the normal increase over a period of years is slight, the time involved is long, a matter of many, many centuries.

Besides the time factor, there are both natural environmental and human factors. Among the natural environmental factors are:

1. The degree of productivity of the soil. This is largely based on the topography of the land, on the climate, and on man, of course, who must manipulate the soil.
2. The length of the growing season, the amount of insolation, and the amount and seasonal distribution of rainfall.
3. The healthfulness of the region.
4. The power and mineral resources.
5. The natural conditions for transportation.

Whereas the climatic factors are fairly constant over even long periods, the resources may become depleted or even exhausted. Man cannot change the climate (except in very local situations, and then only slightly), but he may permit the soil to wear out or be destroyed by erosion and gullying. Coal, oil, gas, metallic minerals, and even some non-metallic minerals may be exhausted. On the other hand, man may by drainage and irrigation make non-productive lands productive and, by careful treatment of the soils, may increase their fertility. He may discover how to utilize materials previously considered worthless. He may improve on the natural transportation facilities, deepen harbors and rivers, excavate canals, bore tunnels, and construct bridges.

The human factors are highly variable. Man is constantly improving his methods and techniques in the utilization of natural resources. The most variable of all human factors, the most uncertain, are man's standards of living and his social ideals and practices. Resources and their utilization concern the production of consumers' goods, and the standards of living affect consumption. Both, therefore, are involved in estimating the number of people a given area may support.

MAN IN NORTH AMERICA

American civilization is transplanted European civilization modified, to some extent, by adaptations to the American natural environment. Europeans brought with them experiences and techniques in the utilization of resources and unbounded human energy that enabled them to reach on the North American continent, within two or three centuries, economic and social developments that had taken Europeans thousands of years to evolve.

In a few regions on the North American continent the Indian had made much advance, as in central Mexico, in and about the Mexican basin, in Yucatan and the lands to the south, in what is now the United States Southwest, central New York, and the mountain valleys of the south. But in most parts of North America there were no barriers to protect a nascent civilization from hostile marauders or to check the wandering habits of the people. Apparently, judging from a world-wide study of evolving civilizations, an increasing population is the dynamic factor, the urge, that forces man into a more advanced type of land utilization. Accompanying this is an advance in culture. There is little doubt that in time the majority of the Indian tribes of North America would have developed an advanced civilization, but it would have taken many thousands of years. A small percentage of the Indians of Mexico and Central America have participated actively.

since about 1820, in the development of Latin North America, but it is to the white man that we owe the present-day advance in the United States and Canada, i.e., in English America.

The Areas of Moderate to Very Dense Population. When migrants spread over a continent, as the Europeans and their descendants did in the exploration and settlement of North America, they tend to select the regions best suited to supply them the necessities of life, and surpluses, with the least expenditure of human energy. How well they succeed depends greatly on their experience in pioneering, on their utilization of resources, and on the extent of their knowledge of the continent. Before the survey of the continent is fully completed excellent opportunities are likely to go unclaimed. As the explorers and exploiters gain in experience in their new environments, their degree of utilization increases; and, as the demands on the environment become greater (with increasing population density), the science of production and conservation advances and the environments yield more and more. This makes a still larger population possible. This has been the process and the condition in North America up to the present, at least. The continent has had an evolving civilization, and the curve of population growth (see Fig. 3) has always had an upward trend. The advances have been most rapid in English North America. Since the migrants to the continent came from the east, the eastern section has the older settlements and the larger population. The southeastern quarter of English America has by far the most people of the continent (Fig. 1). In this most densely settled area live more than four-fifths of the people of the United States and nearly two-thirds of Canada's population. Here are the largest number of cities and the largest cities of these two countries. In Canada the most densely settled area is the Great Lakes-St. Lawrence Lowland. This is the industrial section of Canada.

The largest aggregation of people on the whole continent is to be found about the mouth of the Hudson in what we may call the geographic New York area. The center of population of the United States is in southeastern Illinois, but the center of greatest density of population is this small area within a 15-mile radius of the city of New York. From this New York center northeastward to Boston and southwestward to Philadelphia is the most densely settled area, for its size, on the continent.

Why this great concentration of people? Largely because it is here that natural conditions have, since the earliest period of occupancy of the region by Europeans, been highly favorable for man to make a living, through commerce, manufacturing, transportation, and financial transactions. Some of the natural environmental conditions that have favored man's work here are: location on the shores of the North Atlantic, which has, since the settlement of the Americas, been the busiest of oceans; close and relatively easy contacts with the great interior of the continent; proximity to the great coal and oil (oil is nearing exhaustion) fields of the northern Appalachians; and a large amount of water power. The present-day activities are, of course, based to some degree on developments in the past. Men and women have flocked to this center from both home and abroad. Nearly all of the millions of

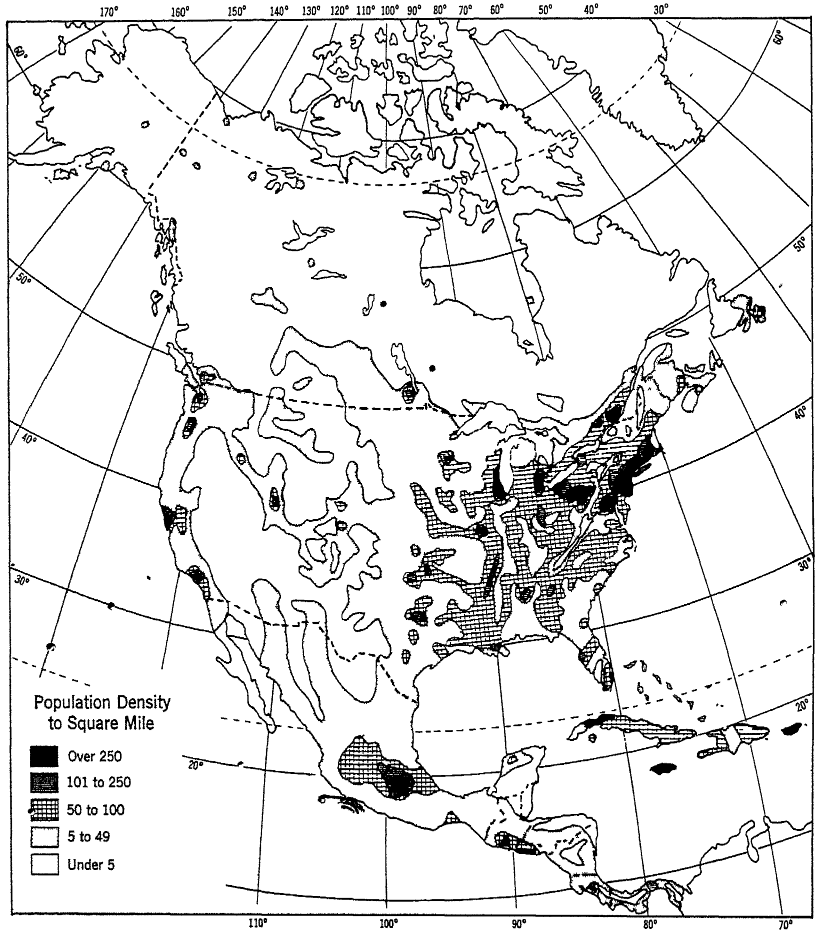


Fig. 1. Density of population in North America.

immigrants that have come to America, chiefly to improve their economic conditions, have entered through the ports of this area.

Factories, docks, banks, customs houses, steamboats, and railways are not, however, the only elements in the cultural landscape. Here for more than a century man has practiced intensive agriculture, and extensive agriculture for two centuries before this. The farmers are producing far more to the acre than the farmers of most other sections of the United States. Yet so many are the urban dwellers and so few the farmers of this manufacturing-commercial area that the area is "parasitic." Both men and machines must be fed by other regions. Even the farmers producing specialties in foods purchase a large part of their food elsewhere, and the dairymen import much of the concentrated feed supplied to their cattle. In this relationship of man and factories to food and raw materials, transportation plays an active part.

Each of the other more densely populated sections in eastern United States and Canada, shown on Fig. 1, has similar advantages for manufacturing and commerce. Some centers like Pittsburgh, Cleveland, Detroit, and Chicago have become world famous as manufacturers of some special type of commodity.

The most densely settled area of Mexico is about the capital city, Mexico, D.F. As in most Latin American countries, the capital city is the most populous in the realm, for it is both a political and a social center. Here live, for a part of the year at least, a large percentage of the wealthy landowners, and with each is a retinue of servants. Mexico, D.F., is not without its factories. Here, too, are many of the headquarters of the companies (a great number of them foreign) that operate mines, factories, and other large enterprises.

The plateau of central Mexico has many attractions for the farmer. It has moderate rainfall and mild temperatures the year round over a large area. The mountainous character of the surface greatly restricts the area suitable for cultivation, but there are productive valleys; and the low standard of living of a large part of the rural population makes it possible for a few acres of cultivated land per farm to sustain a large family.

The Areas of Low Population Density in the United States. Western United States (westward from the 100th meridian, approximately), is sparsely settled, though its area is nearly half that of the United States.

Man and his works are very unevenly distributed in the West. He lives, as a rule, where water is available. Taking the region as a whole, water is scarce. In the Pacific Northwest, west of the mountains, rainfall is both abundant and fairly well distributed seasonally. Elsewhere rains fall mostly on the mountains, and from here man directs it, by irrigation works, upon valley and piedmont lands. The irrigated acreage is very unevenly distributed, and, hence, the population is widely scattered. Cultivation, in general, is intensive. The population density on the irrigated lands is, therefore, greater than in the average rural community in the humid sections of the United States. Irrigation farming, mining, grazing, lumbering, commerce, transportation, and some dry- and humid-land farming are the occupations that sustain the people in this land of little rainfall. The sparsity of population in a large part of this vast area is due primarily to aridity.

Although the lack of water restricts the number of people engaged in agriculture, it has little effect on the population that earns, or might earn, its living from mining. Mining companies in some locations are put to great expense to provide water for their operations, particularly in the concentration and separation of the metals. Few mineral deposits, however, are unworked because of a lack of water.

That an ocean location offers superior advantages for people to make a living is evidenced by the fact that four of the six larger cities of the West are Pacific Ocean ports, with factories and commercial ties that extend to many lands on the shores of the great ocean, some of them also to the Atlantic. California and Washington have densities of population like those of the Midwest.

Areas of Low Population Density in Mexico and Canada. Types of land utilization similar to that of the arid United States West support the people of Mexico in the area of thin population. Living, however, is on a far lower scale of existence. A large fraction of the population of northern Mexico and southern Yucatan is almost as untouched by modern civilization as in the days of Cortez. Here and there irrigation works on a large scale have been set up, and in northern Yucatan commercial farming of henequen supports part of the population. But most of the people live by rather primitive agriculture.

Canada has the bulk of the unoccupied land of the continent. The thinly settled areas form a narrow fringe scarcely more than 100 miles wide along a part of the northern border of the United States. The remainder of the scant population of this vast country, which is larger in square miles than the United States, is less than 2 people to the square mile.

This small population and the vast area of unoccupied land are not because man is a recent arrival, for some of the oldest settlements in English North America were made (by the French) in Maritime Canada, along the St. Lawrence, and on the shores of the Great Lakes. Environmental, geographic, and historical conditions and circumstances have conspired against man's establishing himself in large numbers in Canada.

Canada's proximity to the United States is a factor of no small influence in checking Canada's growth. The United States to the south, with a more genial climate, cheap lands, democratic institutions (Canada was a French and later a British colony until 1867), and greater reputation as a home for the poor, landless, and persecuted drew to its shores the vast bulk of Europeans who crossed the Atlantic to find a home in North America. Some manufacturing and intensive agriculture in parts of the St. Lawrence Plains, extensive agriculture in Maritime Canada and the Prairie Plains, grazing, fishing, lumbering, mining, and fur collecting are now the sustenance activities of the people of Canada.

A Comparison of the Continents. North America, after more than three centuries of occupancy by Europeans and their descendants, has come to have some 200,000,000 people. In area, population, and population density, it is third in rank among the continents. These statistical comparisons may be read from Table I.

TABLE I

A Comparison of the Continents

Continent	Area in Square Miles (000 omitted)	Population* (000 omitted)	Density (per square mile)
North America	9,360	206,000	22.0
South America	6,825	104,000	15.2
Europe	3,774	532,000	140.9
Asia	16,495	1,285,000	77.9
Africa	11,530	187,000	16.2
Australia	2,975	7,700	2.6
Antarctica	5,363		
Total	56,322	2,321,700	

* Estimates.

Although North America falls far short of being as populous as Asia or Europe, its people have made great progress in the utilization of its rich store of resources and the establishment of civilization. Its youthfulness is a factor in its favor. For a long time to come, man will find here wonderful economic opportunities, superior to those of most other continents, for the acquisition of these things for which he has ever been seeking—peace, a home and its comforts, wealth, and influence. North

America today is the most advanced of the continental colonies of Europe.

THE FUTURE POPULATION OF NORTH AMERICA

Curves of Population Growth. Many students of population phenomena find curves of population growth of great value in projecting trends into the future. In Fig. 2 are presented the population curves for the United States, England and Wales, Europe, and the world, covering the period from 1700 to 1930. Note that the vertical units—ordinates—differ in value in the curves. It should be noted, also, that the curves assume a common form. There is first a period of slow growth, followed by a period of rapid growth; and all the curves, by 1930, begin to show a decrease in the rate of slower growth. They begin to show a veering to the right, a tendency to establish a plateau. There is every reason, backed by some experimentation, for believing that all nations will eventually reach a stationary stage in their population growth when their people become so numerous as to approach, or arrive at, the limits of the sustenance power of their environment. Sustenance includes both the products of the soil raised within the country and the output of the mines and factories which are exchanged with other peoples for sustenance products. How many hundreds or thousands of years in the future it will be before the limits of sustenance of a given country are reached, only time can tell.

In the portions of the curves shown in Fig. 2 and marked "hypothetical," many changes in the indicated trends may occur.

We may consider a composite of these curves the normal curve form of population growth.

Another conclusion we draw from these curves (backed also by much other evidence) is that the vertical swing of the curve, the total growth in population, is roughly proportional to the size of the areas involved and their store of resources. It should be noted that the ordinate units (value of the units the same), the vertical range, of the curve of population growth of Europe are far less than those for the world; and that the curve for England and Wales would have a far lower vertical range than that for the United States if both were reduced to the same value for ordinate units.

The Population Curve of North America. From a study of these curves we are led to believe that the population curve for North America up to the present (if complete data were available for its construction) would, in most respects, resemble that for the United States in form, but its vertical range (if the same units of value were used) would, of course, be greater. *The ultimate population of the world will be limited by the amount of food that the lands and waters of the world can be made to produce and the average per capita consumption of this food.* For a region, country, or continent the limits of population are set not alone by the area's ability to produce foods, but also by the resources that favor manufacturing and the exportation of fabricated products for food grown elsewhere. With

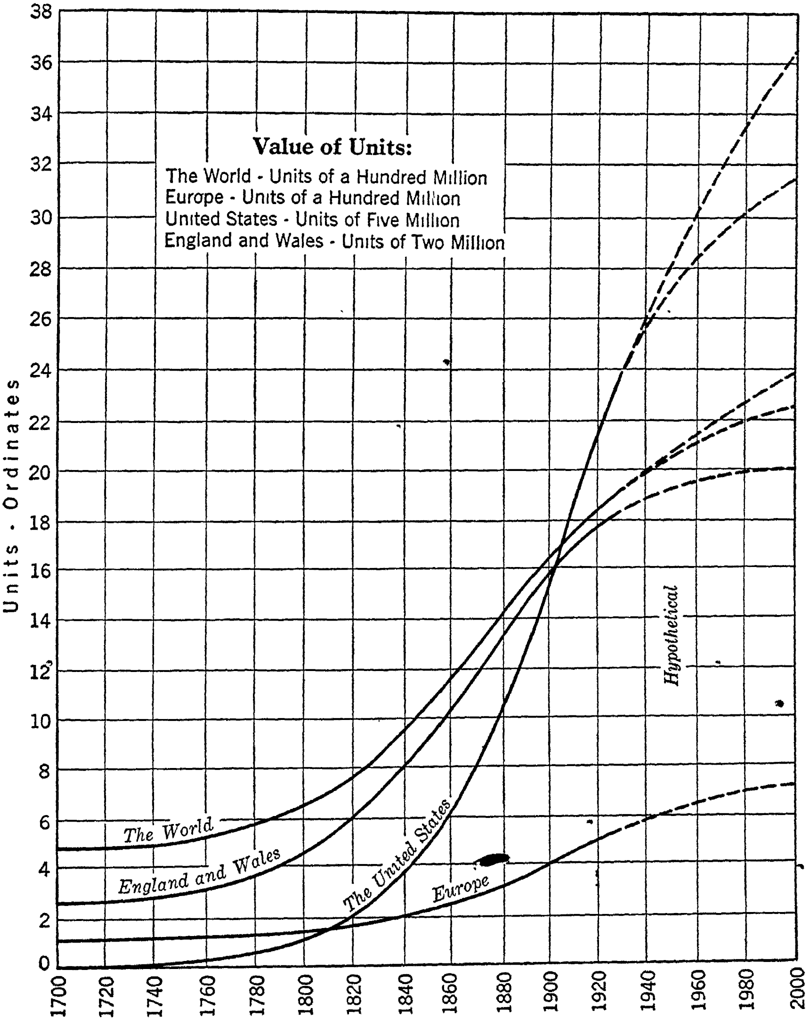
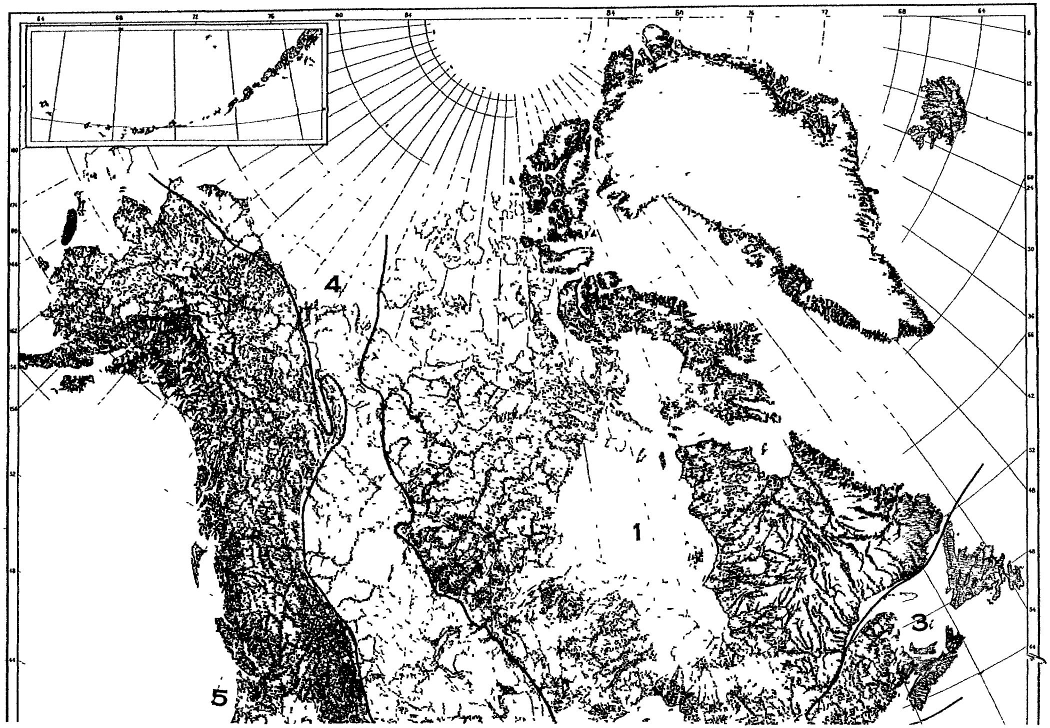


Fig 2. Population curves for the world, England and Wales, the United States, and Europe. The dotted portions of the curves are hypothetical. The curve for North America is similar to that for the United States. *Parkins.*


1
3
4
5

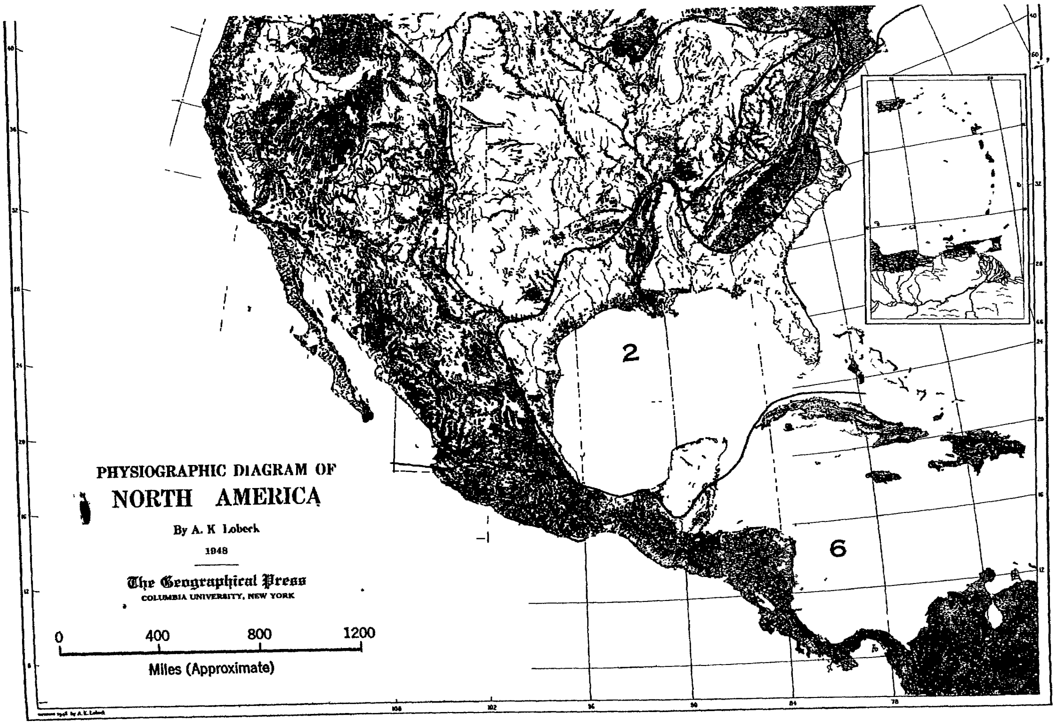


Fig. 3. Major physiographic provinces of North America. *Courtesy, A. K. Lobeck.*

1. Canadian Shield
2. Atlantic Plain
3. Appalachian Highlands
4. Interior Plains
5. North American Cordillera
6. Antillean Mountain System

cheap, efficient transportation and an abundance of power, there is hardly a limit to the population that manufacturing areas may come to support. The limit to manufacturing is the size of the market. In our attempts to get some conception of North America's ultimate population and the limits to which its population curve will rise, both the food-producing ability and the industrial ability of the continent must therefore be considered.

Surface Features Affecting Land Utilization. Plains have always been the seats of dense population groups and the centers of advanced civilizations. The plains of China, the Indus, the Tigris and Euphrates, and the Nile all hold prominent places in history because the people that occupied them have been prosperous and have made valuable contributions to developing world civilization. In North America today, it is almost wholly the plains lands that are occupied by the farmers of the continent. Here soil tends to be deep, leaching and slope wash are at the minimum, and there are few obstructions to the movements of man and the use of machinery.

North America has large areas of plains; the Great Central Plain from the Arctic to the Gulf of Mexico, the Atlantic Slope, the Coastal Plains of Central America (see Fig. 3), and the large river plains like those of the Yukon, Willamette, Sacramento, and San Joaquin. Unfortunately, parts of the plains areas have adverse climatic conditions. The intermontane plateaus that stretch from the Bering Sea to the Isthmus of Tehuantepec, in the western part of the continent, have surface features that offer few obstacles to their use for agriculture; but most of this entire area is too arid or too cold for profitable farming.

Mountain areas, in contrast to plains, do not lend themselves to widespread agriculture and are as a rule but thinly peopled. Agriculture is confined for the most part to the valleys and basins, and it is largely the area and fertility of these that determine the number of people. The slopes unsuited to tillage are likely to be clothed with forests, even if the foothills and plains about are arid; and mountain pasture lands may be utilized by cattle and sheep herders. Minerals and water power may also concentrate people at scattered points; and, if the mountain regions possess beauty of scenery, tourists and students of nature are attracted. Because of the healthful, bracing air of such regions, health resorts are established in them. Yet none of these methods of utilizing the land resources offers favorable conditions for a dense population.

When the mountain areas of the continent are added to the large tracts that are too cold and the other large tracts that are too arid for farming, there remains probably not more than a third of the continent that may be considered ideal (relatively) for agriculture. One is surprised at the vastness of the area that is limited in its value to man because of adverse physiographic and climatic conditions. Yet the other continents, except possibly Europe, are in no way superior to North America in this respect. A comparison of the production of some of the crops of the continents supports this generalization.

A Comparison of the Continents in Agriculture. Although younger historically than either Europe or Asia, with an area only a little more than half that of Asia, and with a population much less than a third of that of Europe and a sixth that of Asia, North America ranks remarkably well in the production of farm crops. Only the widest generalization and conclusion may be made in such comparisons, for latitude positions and other conditions greatly affect the kinds of crops grown, and many data are not reliable.

North America leads the continents in the production of corn, oats, sugar, and cotton, surpasses Asia in wheat, corn, sugar, cotton, and oats, and produces almost as much wheat, more oats, and almost as much rice as Europe. Corn is the outstanding crop of North America, and rice of Asia; and in these crops each leads the world. Can the corn crop of North America offset the rice crop of Asia? Is not the slight lead that Europe has over North America in wheat and rice more than compensated in North America's vastly superior production of corn and cotton? These questions must be answered by the student to his own satisfaction. Since North America is one of the "younger" continents it is likely to continue to hold a prominent rank in agricultural production.

Population Based on Agriculture. It has previously been pointed out that the ultimate population of a continent where economic existence is based on agriculture alone will be limited by the amount of food that the continent can produce. And as we have pointed out, the food-producing power of North America is based, so far as nature determines, on the area of land that has favorable climatic and topographic conditions. Man is an important factor, of course, since the amount of food that may be produced depends on his experience and technical skill in making nature "work" for him. In Europe, for example, for hundreds of years before about 1840 the average yield of wheat was 10 to 12 bushels to the acre. After Liebig's epoch-making experiments and discoveries in the chemistry of agriculture became known and utilized in soil improvement, the yield of wheat was gradually increased until, in countries like Britain and Belgium, the average is about 30 to 35 bushels, and many fields produce 50 to 60. There is, of course, no reason for thinking that improvements are at an end. The checking of soil erosion, careful selection of seed, careful adaptation of crop to soil and climate, breeding of new varieties of plants, introduction of new plants, better methods of tillage, more careful application of manures and fertilizers, improvements in the application of water to irrigated lands, and many other methods and practices recognized as improvements by agricultural experts, if applied to all the lands in North America to which they are applicable, will greatly increase yield and establish permanent agriculture. So far most of our farming has been exploitive. A hundred years ago the farmers of Europe and America had no conception of the great improvements that science would make, and did make, in the century following. We, at present, have no idea of the developments during the century to come. Yes, centuries to come, for there is every reason to believe that man will continue on and on for thousands and thousands and millions of years as the dominant form of life on this globe, and we feel confident that he will ever need to go to the soil for his sustenance.

In trying to form an estimate of the productive power of the agricultural lands of North America, we, of course, have limitations. We tend to form our judgments on the basis of present-day methods and practices of agricultural production.

Subsequent chapters present fairly complete discussions of the potentialities of all the countries and regions of the continent. The population possibilities are far from being uniform over the continent. The United States will always dominate by sheer numbers, but both Canada and Latin North America are capable of supporting many more people. From data available it seems probable that the continent can ultimately sustain 500,000,000 to 600,000,000 people by agriculture, practicing methods of land utilization now known, and maintaining a high-level standard of living. Although these estimates must be based on many variables, they give us an idea of the terms in which to think in evaluating the continent. Other resources, such as minerals, may be produced and exported either in the crude or fabricated form, in exchange for food.

CLIMATE AND HUMAN OCCUPANCY

It is probable that climate and weather exert a greater influence on man than any other elements in his natural environment. Soil is largely a product of climate and weather processing, and its productive value to man is dependent on climate and weather. Climate is commonly described as the mathematical mean of the weather, that is, of the conditions existing from day to day. All the elements of weather and climate—temperature, pressure, winds, and moisture—are measurable by specially devised instruments, and the measurements are expressed in mathematical terms. Averages and means are therefore easily determined. However, this is an oversimplification of the meaning of climate. Data must be given for extremes as well as means, for departures from the normal as well as for the normal, and for seasonal, monthly, or daily as well as annual ranges. Man tends to adjust his activities to the averages or means of weather and climate; yet it is the extremes of heat and cold, excessive falls of rain or unusually long droughts, and unseasonable frosts that often spell success or failure to his economic

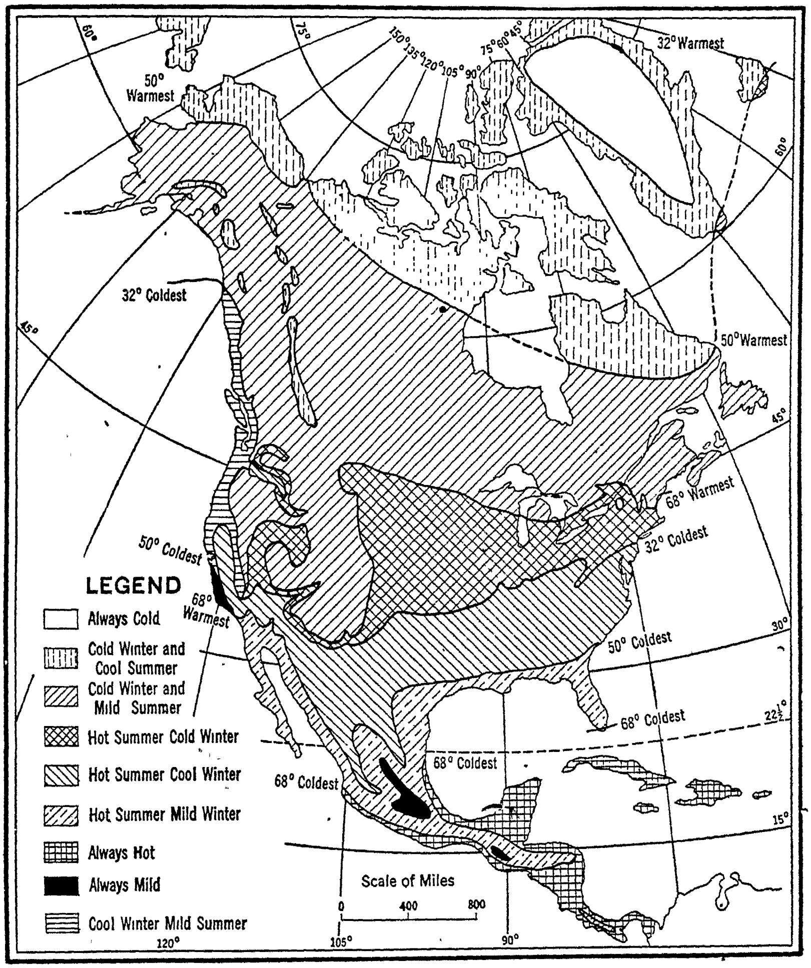


Fig. 4. Temperature regions of North America. *Parkins.*

activities. In this chapter, only the main outstanding characteristics of the climate of the continent are presented, details being left to subsequent chapters.

Some Major Factors Affecting Climate. The location of North America in latitude and its latitude extent are among the important factors in its geography, determining the angle at which the sun's rays strike the land surface throughout the year, and thus its solar climate; determining what winds blow across the land, and thereby influencing both the areal and the seasonal distribution of rain. How unlike present conditions would man's life be if the continent extended from the equator to 50° N.! The longitude extent is one of the factors that affect the amount of rainfall of the interior; but more important are the surface features—altitude, and distribution of mountains and plains, the relation of the prevailing winds to ocean currents, and the location of storm tracks.

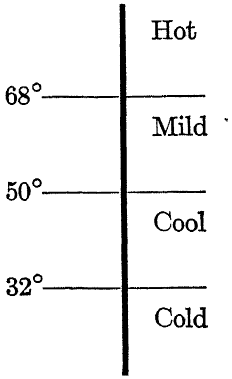


Fig. 5. Four types of months. The vertical line may be thought of as a thermometer scale showing monthly averages. *Parkins.*

Temperature Conditions of the Continent. Except in the most general way, maps of so-called climatic zones have little value, for zones are the resultants of solar control, and the effect of solar control is so modified by other conditions that some visualizing device must be used that contains as many of the factors controlling climate as may be conveniently shown on a map. We shall contine to talk about the tropics, the temperate regions, the polar or frigid zones, but always with a feeling of the inadequacy of the age-old terms to express climatic conditions. So also must sea-level isothermal maps be discarded, for man carries on his activities on the surface of the earth and geography is a study of man's activties as adaptions or adjustments to the natural environment. Maps of mean annual temperatures have little value in presenting the geography of regions, except in the hot, moist tropics. Surface isothermal maps of the warmest and coldest months or for summer and winter, and surface temperature-region maps are better visualizing devices.

The Temperature-Region Map. Temperature (i.e., heat) is one of the major elements of climate, and its seasonal distribution affects the habitability of the continent. The simplified temperature-region map, Fig. 4, shows surface temperatures grouped into regions. The regions are bounded by selected isotherms, the 32°, 50°, and 68° for the coldest month, and the 32°, 50°, and 68° for the warmest month. The two sets of isotherms are, after all, but one set that migrates northward and southward with the sun. On the map, the 32°, 50°, and 68° [1] isotherms are shown in their January and July positions. Each region is designated in such a way that the temperature conditions of both winter and summer are indicated, the coldest and warmest month giving the temperature characteristics of the winter or summer season. The temperature regions are the areas between the isotherms. This arrangement of isotherms gives nine temperature regions for the world. Because of the great latitude extent of North America, its latitude position and its large area, the whole series of regions is found in this continent.

The Types of Months. The nine regions are a combination of but four types of months: cold, cool, mild, and hot. The temperature range of each of these types is indicated by Fig. 5, which may be thought of as a thermometer scale showing monthly means with three points, 32°, 50°, and 68°. A month with a mean temperature above 68° is considered a *hot* month. If the mean lies between 50° and 68°, the month is *mild;* between 32° and 50°, *cool;* and below 32°, *cold.* The average temperatures of January and July at any place determine the temperature region in which that place falls.

The Annual Rainfall. The map of annual rainfall of North America, Fig. 6, shows a long, narrow strip bordering the Pacific from 40° N. to 60° N., having 60 inches of rain. Bordering this section of very heavy rain are strips, each with decreasing amounts, lying to the eastward. Most of the western highland and mountain area and the Great Plains have less than 20 inches, but some of this section has less than 10 (very scant), and some more than 20. The southeastern third of the continent has 20 inches or more, and the southeastern quarter of the United States has 40–80 inches. From the Gulf of Mexico northward in the eastern half of North America, there is a decreasing amount of rain. On the other hand, from about the parallel 23° southward in Mexico and Central America, there is an increasing amount. It is significant that a large part of the continent has rainfall sufficient to produce useful vegetation. These facts of rainfall distribution are phases of geography. The explanation of these facts belongs, strictly speaking, to meteor-

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[1] These three temperatures have ecological significance. The 68° isotherm for the coldest month is the approximate poleward limit of the palm; the 50° isotherm for the warmest month is the poleward limit of tree growth; and the 32° isotherm marks the frost line.

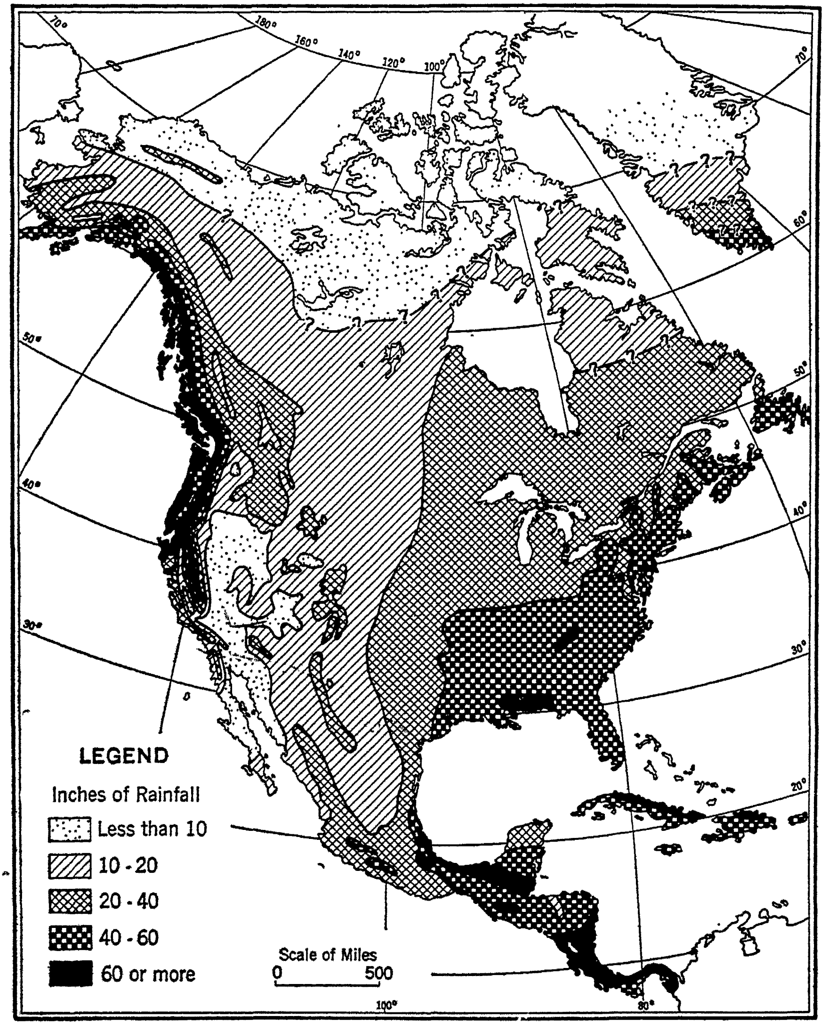

Fig. 6. Annual rainfall of North America. *Parkins.*

ology. However, a brief summary of certain causal factors, such as winds, highlands, lowlands, and major water bodies, will help in understanding the rainfall distribution.[2]

North America north of 30°–35° N. latitude, is in the belt of the *Westerlies.* South of 25°–30° the *Northeast Trades* prevail. Northern Mexico and southwestern United States form an area that is debatable ground between the *Westerlies* and the *Northeast Trades.*

The west wind off the Pacific gives the very heavy rainfall on the Pacific Slope. The air, laden with moisture, is adiabatically cooled as it moves up over the Coast Range and again over the still higher Cascade-Sierra Nevada Range, and rain falls. The air descending on the eastern slope is warmed and becomes moisture-absorbing rather than moisture-giving. East-facing slopes (leeward) of these mountains, therefore, have less rainfall than west-facing (windward), yet are not so dry as the leeward lands at lower altitudes because the clouds that precipitate the moisture on the windward slopes are carried over beyond the crests of mountain ridges before the air begins its descent.

Most of the plateau between the Pacific ranges and the Rockies lies much below the level of the mountains to the west; it is therefore a region of low precipitation. The driest sections lie just to the east of the highest portion of the Pacific ranges.

There is rain on the Southern Rockies because many mountains stand even higher than the High Sierras. The Northern Rockies, although lower in altitude than the Southern Rockies and the still lower mountains of Idaho and northern Oregon, have moderate rainfall, chiefly because the Pacific ranges northward from 45° are less of a barrier to Pacific Ocean air than the mountains farther south. East of the Rockies, the eastward-moving air descends, is warmed, and becomes moisture-absorbing.

Since the eastern half of North America, north of 25° N., lies at a lower altitude than the western mountains and plateaus, how is it that the *Westerlies* bring rain to it and spread this rain copiously over a large area?

The low-pressure air masses, great eddies of air moving eastward and northeastward, largely from the Pacific, a few from the Gulf of Mexico and the Carribean, across North America in the belt of the *Westerlies,* give rain to the continent north of 30° to 35° N. latitude. Air moves into these low-pressure eddies from all points of the compass and is gradually forced upward. This upward-moving air is cooled by expansion, and moisture is precipitated. In the western half of North America, the rain-giving winds are moving from the Pacific to the Low. In the eastern half, the winds from the Gulf and the Atlantic bring the moisture. The Rockies, in a rough way, act as a great divide in the movement of the moisture that comes from the oceans and falls as rain. A Low on the western border of the Great Central Plain, to a large degree, draws in dry winds from the west; but if this Low is well developed it may affect the movement of air 800 miles or more to the east and southeast, even as far as the Gulf of Mexico or the Atlantic. Moisture-laden air starts from these bodies of water toward the center of the Low. While this air is moving northwestward the Low is moving eastward, and, by the time Gulf and Atlantic air gets to the Low center, the Low center has traveled several hundred miles from the western margin of the Great Central Plain. Much of the western margin of the Great Central Plain is, therefore, semiarid. Some of the water that falls as rain in Iowa, for example, has probably not come directly from the Atlantic or the Gulf. Part of it is reevaporated moisture from previous rains.

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[2] For a more complete discussion of climate see Trewartha, *An Introduction to Weather and Climate,* McGraw-Hill, 1949.

Low temperature, and thus limited capacity of the air for holding moisture, is the chief reason for the scant rainfall of the Arctic Slope. On the other hand, the high moisture capacity of the air in the tropical region of North America and the *Trade Winds* (for the most part) give moderate to very heavy rainfall in southern Mexico, Central America, and the West Indies. Windward slopes have the heavier rainfall. Some of the summer rain in Middle America comes from the northward-moving *Doldrum* belt.

Seasonal Distribution of Rainfall. The seasonal distribution of rainfall is of vital importance to the farmer. Thirty inches of rain, with a large fraction coming in frequent gentle showers during the growing season, may provide more moisture for crops than 50 inches occurring largely during the late fall and winter. Figures 7 and 8 show the winter and summer distribution of rainfall. In winter the eastern and most of the western margins of the continent have more than 6 inches and the interior, from the Arctic to central Mexico, is dry. In summer a large part of the continent has more than 6 inches, including much of the Plains area. Except for relatively small areas the whole continent receives a moisture supply in the spring and summer. However, some areas (Fig. 7) are arid. A composite map of topography, heat, rainfall, and native vegetation indicates that nearly all the plains and lowlands, and many of the highlands, have sufficient heat and summer moisture for the growing of vegetation of value to man. This includes the Arctic tundra, grassland pastures, and forest lands. This favorable seasonal distribution is an important factor in man's use of the continent.

Climatic Regions of North America. Figure 9 shows the major climatic regions of North America as developed by Dr. Trewartha. Climatic regions are largely a combination of temperature and rainfall regions, but seasonal distribution of rain and the rate (known or probable) of evaporation are given due weight. Therefore, isotherms and isohyets constitute, ~~for the most part,~~ the boundaries of the regions, and the names of the regions express both rainfall and temperature conditions. It will be noted that the climates of the continent include nearly all types, ranging from the humid tropical rainforest to polar ice cap to hot deserts. Continental interior climates, as usual, are characterized by extremes, but a large proportion of the continent, especially the eastern half, has warm summers and a supply of moisture. The large area having a microthermal climate (Dcf) produces forest, and the polar area (ET) produces vegetation suitable for reindeer and caribou pasture. The climates of the west coast range from polar, microthermal, mesothermal, tropical and subtropical desert, to tropical savanna. This great variety of climates enables man to produce a great variety of products. It is probable that the continent is capable of producing any vegetative growth that man utilizes in any other part of the world. Suppose you could wave the "magic wand" and change the climate of the continent, what changes would you make? Suppose you could cut down the western highlands to an altitude of 1000 feet, how would the climates of North America be changed? Would conditions be more, or less, favorable to man?

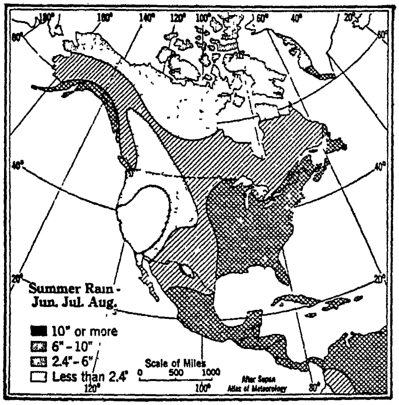

Summer Rain - Jun. Jul. Aug.
■ 10" or more
▨ 6"-10"
▨ 2.4"-6"
☐ Less than 2.4"
Scale of Miles 0 500 1000
After Supan Atlas of Meteorology

Fig. 7.

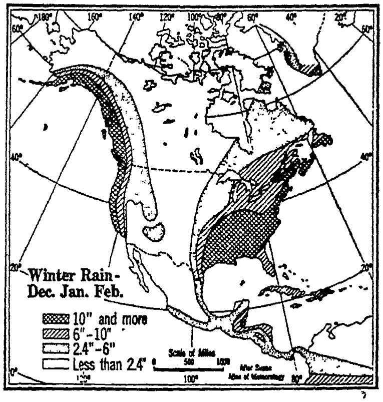
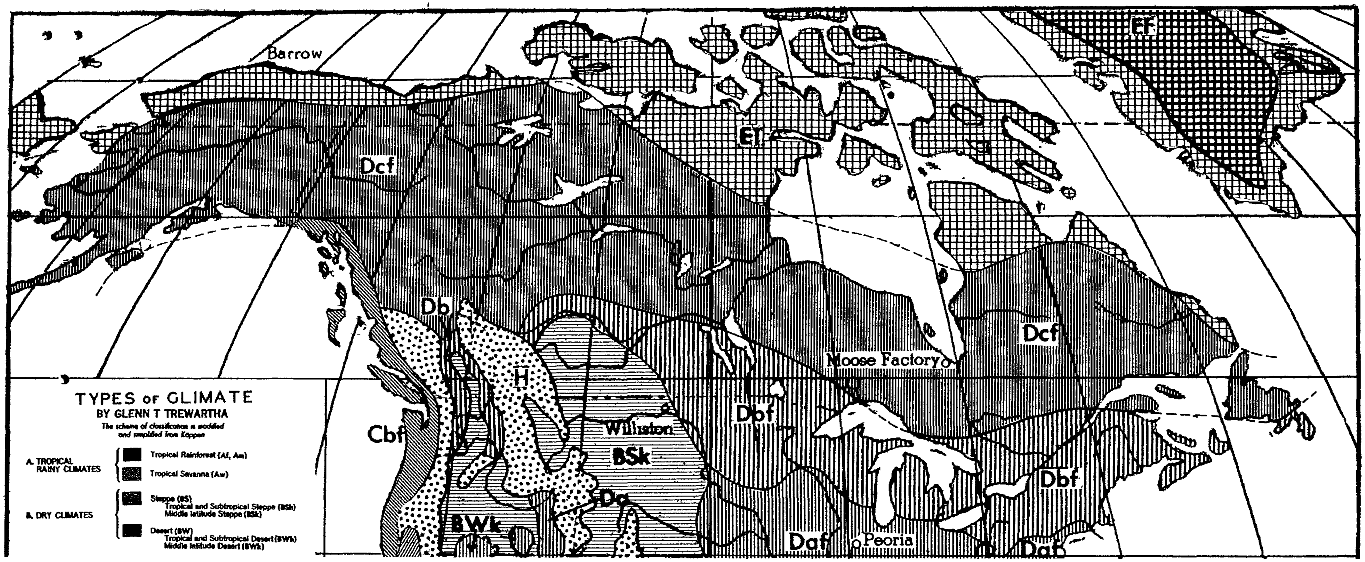


Fig. 8.

MINERAL RESOURCES AFFECTING OCCUPANCY

Europe, the United States, and southern Canada are probably the best known geologically; yet in the United States new deposits of useful


Barrow
EF
ET
Dcf
Dcf
Moose Factory
Db
H
Cbf
Dbf
Williston
BSk
Da
BWk
Daf
Peoria
Dbf
Daf
TYPES oF CLIMATE
BY GLENN T TREWARTHA
The scheme of classification is modified and simplified from Köppen
A. TROPICAL RAINY CLIMATES
Tropical Rainforest (Af, Am)
Tropical Savanna (Aw)
B. DRY CLIMATES
Steppe (BS)
Tropical and Subtropical Steppe (BSh)
Middle latitude Steppe (BSk)
Desert (BW)
Tropical and Subtropical Desert (BWh)
Middle latitude Desert (BWk)

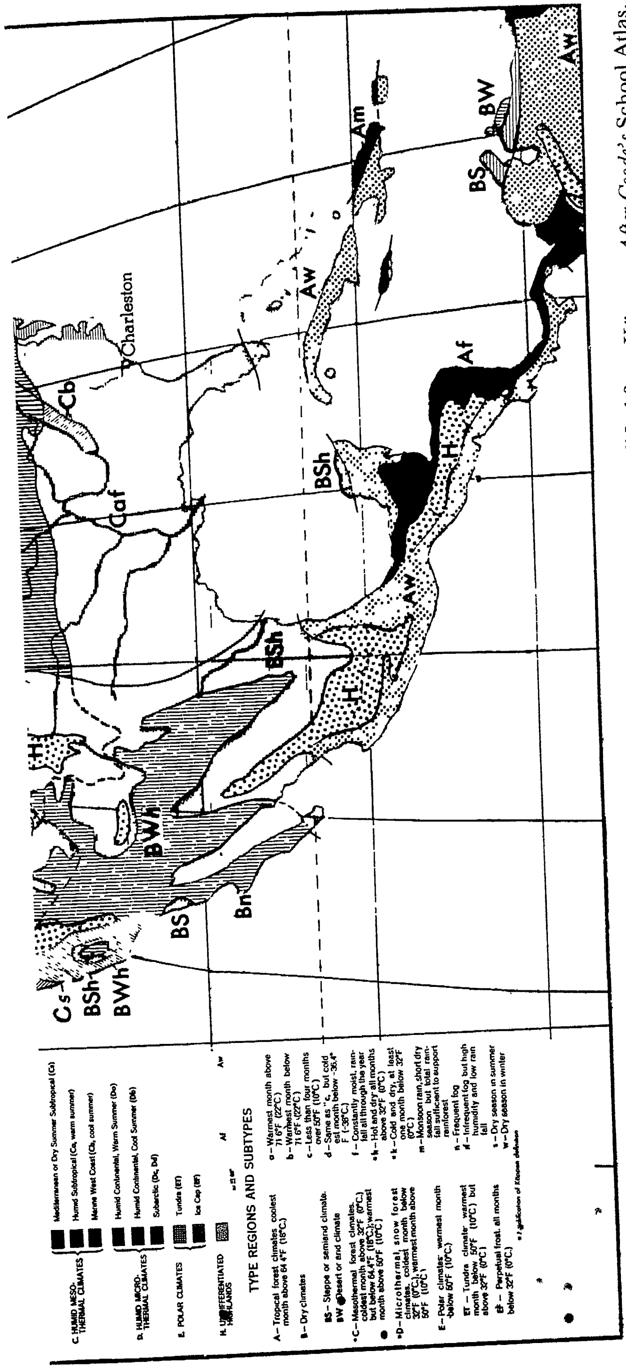

Cs
BSh
BWh
BS
Bn
BWh
H
BSh
H
Caf
Cb
Charleston
BSh
Aw
H
Af
Aw
Am
BS
BW
Aw
C. HUMID MESO-THERMAL CLIMATES
Mediterranean or Dry Summer Subtropical (Cs)
Humid Subtropical (Ca, warm summer)
Marine West Coast (Cb, cool summer)
D. HUMID MICRO-THERMAL CLIMATES
Humid Continental, Warm Summer (Da)
Humid Continental, Cool Summer (Db)
Subarctic (Dc, Dd)
E. POLAR CLIMATES
Tundra (ET)
Ice Cap (EF)
H. UNDIFFERENTIATED HIGHLANDS
TYPE REGIONS AND SUBTYPES
A–Tropical forest climates, coolest month above 64.4°F (18°C)
B–Dry climates
BS–Steppe or semiarid climate.
BW–Desert or arid climate
C–Mesothermal forest climates, coldest month above 32°F (0°C) but below 64.4°F (18°C); warmest month above 50°F (10°C)
D–Microthermal, snow forest climates, coldest month below 32°F (0°C), warmest month above 50°F (10°C)
E–Polar climates: warmest month below 50°F (10°C)
ET – Tundra climate: warmest month below 50°F (10°C) but above 32°F (0°C)
EF – Perpetual frost, all months below 32°F (0°C)
a–Warmest month above 71.6°F (22°C)
b–Warmest month below 71.6°F (22°C)
c–Less than four months over 50°F (10°C)
d–Same as "c," but coldest month below -36.4°F (-38°C)
f–Constantly moist, rainfall all through the year
h–Hot and dry: all months above 32°F (0°C)
k–Cold and dry, at least one month below 32°F (0°C)
m–Monsoon rain, short dry season but total rainfall sufficient to support rainforest
n–Frequent fog
n'–Infrequent fog but high humidity and low rainfall
s–Dry season in summer
w–Dry season in winter

Fig. 9. Climatic regions of North America. The scheme of classification is modified and simplified from Köppen. *After Goode's* School Atlas, *Courtesy, G. T. Trewartha and Rand McNally & Co.*

minerals are being found every year. More than two-thirds of Canada is yet to be examined in detail for minerals, and few geologists have ever worked systematically in the regions to the south of the United States, or in Africa, Asia, and much of Australia. All mineral reserves are of importance to man. The more critical are probably those used for power, the baser metals, and many non-metallic minerals. Only a few, those used for power, are considered here.

The coal resources of the world are probably the best known, yet the available data are little more than estimates. North America has more than half the world's reserves. Only in North America and Europe is coal mined on a large scale. The normal coal production of India and Japan are small compared with U.S.S.R., Great Britain, or United States. The average world production is approximately 1,750,000,000 tons, of which North America produces 600,000,000 tons, Asia about 120,000,000, Europe 590,000,000, Australia and Africa 23,000,000 each. See Table II.

TABLE II

COAL RESERVES OF THE CONTINENTS

	Probable Metric Tons (000,000,000 omitted)	Per Cent of World
North America	2844	51.0
South America	34	0.6
Europe*	619	11.1
U.S.S.R.	1525	27.3
Asia*	297	5.3
Africa	222	4.0
Australasia	34	0.6

Source, "Energy Resources of the World," by U. S. Dept. of State.
* Excluding U.S.S.R.

Petroleum reserves are difficult to estimate, but data available indicate a world reserve of some 95 billion barrels. More than half is in Asia and a little less than a third in North America (Table III). The production in North America, however, is on a huge scale, especially in the United States. North America also has very large resources of other hydrocarbons such as bituminous shales and natural gas.

Reliable estimates of natural gas reserves for the world are not available, and comparable production data are several years old (Table IV). In 1950 the United States production was approximately 220,000 million cubic yards, and its reserves were estimated to be 6900 billion cubic yards. Canada has very large reserves.

TABLE III

PETROLEUM RESERVES BY CONTINENTS *

	Reserves, Barrels (000 omitted	Per Cent of World
North America	28,723,000	30.1
South America	10,650,000	11.2
Europe	6,207,000	6.5
Asia	49,446,000	51.9
Africa	183,000	0.2
Australasia	500	
	95,208,500	99.9

Source, World Oil, Feb. 1951.

* Estimates vary widely and change yearly. Compare with Fig. 26.

TABLE IV

NATURAL GAS PRODUCTION BY CONTINENTS*

	Millions of Cubic Meters	Per Cent of World
North America	69,219	86.9
South America	4,819	6.1
Europe †	2,581	3.2
Asia †	1,047	1.3
U.S.S.R.	2,000	2.5
Africa	8	—
Australia	—	—
	79,674	100.0

Source, "Energy Resources of the World," by U. S. Dept. of State.

* *Data for 1937.*

† Excluding U.S.S.R.

In considering the population of the future in North America, we think chiefly of coal, petroleum, and gas as power resources. To these must be added water power. North America holds third rank among the continents in potential water power, but its ratio of developed to potential ranks first, and it has large reserves for future use (Table V). The significance of the tremendous power resources of North America derived from the utilization of coal, natural gas, petroleum, and water power is realized only when considered in comparison with human power, the power now characteristic of the tropics, the East, and to some extent of many of the countries of Europe. Engineers have found that the energy stored up in 2 pounds of coal, used in an engine of 10 per cent efficiency and expended through a day, will do the work of 1 man, and that the energy output of an average workman is about ⅐ horsepower. On this basis the average daily output of coal mines in the United States is equal to the energy of 1,900,000,000 men. Add to such estimates the human energy equivalent of petroleum, natural gas, and water power produced in North America daily, and the high standard of living and material comforts attained by man are understandable.

Power resources, next to the potential ability of a country to produce foods, are the most important elements of the environmental bases of population. In coal, petroleum, gas, and water power North America has power resources that give it an advantage over any other of the continents.

TABLE V

WATER-POWER RESOURCES BY CONTINENTS*

	Potential (millions of kilowatt-hours)	Per Cent of World	Developed (millions of kilowatt-hours)	Per Cent of Potential
North America	458,688	11.6	73,644	21.6
South America	444,800	11.3	3,029	0.7
Europe †	361,472	9.2	64,125	17.7
Asia †	557,632	14.2	22,752	4.1
U.S.S.R.	465,600	11.8	6,900	1.5
Africa	1,615,864	41.0	542	‡
Australasia and Oceania	34,056	0.9	1,566	4.6
	3,938,112	100.0	172,558	4.3

* From "Energy Resources of the World," by U. S. Dept. of State.
† Excluding U.S.S.R.
‡ Less than 0.05 per cent.

Among the more valuable metallic minerals used in the great industries of today are iron ore, copper, zinc, and bauxite. (See succeeding chapters.) Since North America has a large part of the world's supply of these and of nickel, sulfur, and phosphate; a large share of the power resources of the world; large areas of almost virgin agricultural lands producing their share of the world's agricultural products and capable of several times the present output; and some of the largest stands of timber to be found in any continent (with the possible exception of Asia), both mining and manufacturing will contribute effectively to maintenance of the future population.

POPULATION AND NON-AGRICULTURAL RESOURCES

Owing to its wide range of latitude, great variety of climates, minerals, and native vegetations, the North American continent is nearly self-contained and can long remain so. But it may be a good policy to exchange the products of mines and factories either in the crude or fabricated form for foodstuffs produced in other countries. Britain has been exporting coal, power, and labor for more than a century, and has sustained a population far larger than the British farmers can feed. Every country tends, as its population increases in numbers and density, to advance in its economic evolution from the plucking, gathering, and collecting stage in the exploitation of the resources to extensive agriculture, intensive agriculture, manufacturing, and mining. But for a country to become active in manufacturing it must possess power resources—coal, oil, gas, water power. Only a few countries in the world have the environmental requisites for manufacturing. Fortunately for North America, these more useful minerals are in great abundance. It is evident that our continent will have an abundance of power for manufacturing for centuries to come.

It seems possible that the manufactures of North America—only as the products to be exchanged for food produced in other continents are considered—may expand our sustenance space, so that North America may ultimately come to have (or support) twice the estimated 500 to 600 millions. This we may consider as the environmentally or physically possible population of North America, with man using the types of utilization of resources now known. Whether such a population is desirable, or whether these limits will ever be reached, and how long it will take to reach the ultimate, depend on man himself.

SOME HUMAN FACTORS

Since the beginning of the existence of the human race the curve of the world's population has probably had in general an upward trend. We can hardly avoid such a supposition. The historical glimpses we have of scores of nations throughout the many thousands of years of their known existence indicates that growth in population is a normal condition. Adam Smith, the English economist of the eighteenth century, saw a relationship between economic well-being and rate of growth of population. “The most decisive mark of prosperity of a country, he writes, “is the increase in the numbers of inhabitants.” And again, “No species can ever multiply beyond the means of its subsistence.” For more than a century countries that passed through the Industrial Revolution or that were drawn into the great world-wide maelstrom of commercial relations have experienced a rapid increase in population. All or nearly all the advanced nations of the world have suffered a decline in their rate of increase, i.e., their curve of population is tending toward the horizontal.[3] Civilization apparently carries in its wake, after the effect of the first flush of prosperity wanes, a decrease in the rate of births—and so great a decrease that, though the death rate is greatly reduced through the advance of medical science and improvements in sanitation, there is an actual decline in population growth over a long period. The rising standards of living are important factors in this decline. Ricardo wrote that "a taste for the comforts and enjoyments of life is excellent security against a superabundant population."

At no time in the history of the world has the general public in civilized lands enjoyed so many comforts and so much prosperity. Education now is provided for the masses. Life has lost the drabness that characterized man's living in the earlier centuries. Man on a low plane of existence seems to be governed in his sexual life by the laws of the animal world, but, as his educational and cultural attainments advance and his standards of living are raised, the rate of propagation declines. Intellectual prudence rather than physiological imprudence rules. Fear in the minds of parents of their inability to provide for a large family on the social and economic plane that they desire serves to restrain the birth rate. The parents of each generation desire to give their offspring the best and to save their children from the hardships the parents experienced. Social practices and ideas thus are regulating factors. Perhaps the world may some time see the working out of Herbert Spencer's belief that "in proportion as individual or a community becomes perfected in civilization, in the same proportion the race inclines to run out." There is no telling whither we are headed, whether toward a stronger or a weaker race, a weaker which eventually may not be able to reproduce itself.

The problem of population growth involves two phases of man, the physical and the mental. Through superior intellect man has established dominion over all other forms of life and has learned to utilize many of, and possibly most of, the forces of nature. There is little reason for doubting that the advances in the future will be even greater than in the past. As population increases, man will find new resources and new ways to utilize them, and democracy will see to it that the benefits are more evenly distributed than at present. How these easier conditions will affect the physical man and this, in turn, the growth of population in North America cannot be foretold. It seems to be a law of nature that progress and development, physical and mental, come only through work, the conquest of adversity, and success in the struggle against physical and mental inertia.

[3] The rapid rate of increase in the United States since World War II may be only temporary.

Some are likely to be too optimistic as to the efficacy of science to solve the problems of human existence in the centuries to come. Medical science can greatly reduce the toll of disease, reform our diet, and establish standards of sane living. But will people listen to its teaching? Food, produced by nature, is certain to remain a limiting factor in the population of the world. There is little hope that man will ever be able to thrive on a daily ration of compressed, synthetic tablets carried about in a single pill box. If we may judge from the past, he will continue to eat carbohydrates and proteins and will demand spinach for roughage, and all these will be produced more cheaply by Dame Nature's plant, by sunlight, rain, and soil, than in a chemical factory.

The resources of the North American continent—soil, climate, minerals, water, native vegetation, and natural transportation conditions—and their degree of utilization condition the continent's sustenance power; but many human factors will determine whether the sustenance possibilities will ever be levied upon by a thousand million or more people. Trends observable in many population phenomena today lead many to think that we will come to have a stationary population before we reach even half that number.

QUESTIONS, EXERCISES, AND PROBLEMS

1. The *Statistical Abstract* gives normal temperatures for selected stations in the United States. Select ten or more widely distributed stations and, from a study of the data for these stations, determine in what temperature regions they are.

2. Data for normal monthly precipitation may also be obtained from *Statistical Abstract*. Select six or more stations in various parts of the country and construct graphs showing the seasonal distribution of rainfall.

3. If it were possible to make changes in the physical environment of North America, what changes would you suggest to increase the usefulness of the continent to man? Consider changes in the varieties and distribution of mineral resources, in surface features, navigable rivers, temperatures and rainfall, and location.

4. What part of the continent would have the denser population today if North America had been settled from the Pacific instead of the Atlantic?

PART II

The United States and Alaska

CHAPTER 2

The United States as a National Unit

In the United States lives a people under conditions that are far superior to those of any like area of the earth. The natural environment has provided opportunities which enabled a capable people, in a short period, to attain a high stage of prosperity and evolve a nation that ranks among the first. Its past history is largely a record of man's exploitation of superb natural resources. Static conditions, or relatively permanent adjustment, have not yet been attained in many activities. The process of human evolution, by which man finally makes the most complete use of the natural assets of his environment, is still in progress. Absolutely permanent adjustment, of course, will never occur with a progressive people. The people of the United States are still profiting chiefly by using the superabundant natural gifts of the most richly endowed political unit of the world. They still seem to be unaware that many of their resources are being exhausted. They produce and destroy with little regard for the future. The future alone can record whether the country wields as great an influence in the world and makes as great contributions to the advancement of human welfare as the countries of Europe. Though material resources that assure opportunities for maintaining high standards still exist, the day of free land—"Uncle Sam is rich enough to give us all a farm"—has gone. Forests and soils are being depleted rapidly, mineral production is on a huge scale and the date of exhaustion is in sight for some minerals, and population is increasing at a high rate. *It is the principal purpose of this chapter to provide an over-view of the United States as a nation by considering some of the major aspects of its development and some of the opportunities available to future generations; and, perhaps, to awaken an appreciation of "Our Own United States."* More detailed discussion of sections of the country follows in succeeding chapters.

A Region and Its People. People everywhere live in a given area or regional environment, *and their opportunities depend upon* (1) *the size of the region,* (2) *the natural resources of the region, and* (3) *the number and ability of people competing for participation in those resources.* Such regions may be political; physiographic, geographic, natural, etc., and the opportunities

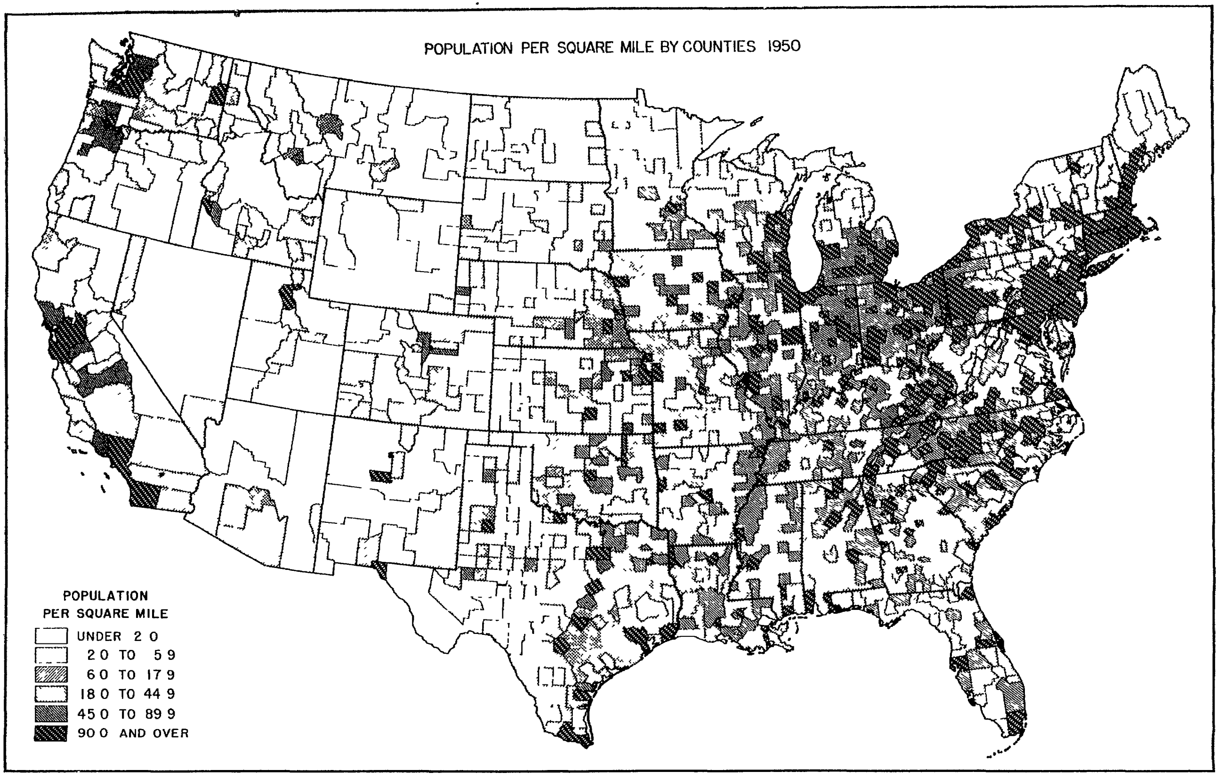

POPULATION PER SQUARE MILE BY COUNTIES 1950
POPULATION PER SQUARE MILE
UNDER 2.0
2.0 TO 5.9
6.0 TO 17.9
18.0 TO 44.9
45.0 TO 89.9
90.0 AND OVER

Fig. 10. Distribution of population. *Courtesy, Bureau of the Census.*

offered may be few or many. Perhaps the cycle in which man modifies his environment in order that he may make the most of opportunities available, and the environment modifies man in turn, *ad infinitum,* holds as a general principle. Possibly the operation of such a principle accounts for the present degree of social and intellectual attainment of the more advanced peoples. However, there are so many modifiying factors, both within and without a given environment, that the general principle cannot be considered an immutable law. Certainly, what man does is influenced greatly by the environment in which he lives; but it is equally certain that not all racial stocks produce the same results in the same or in a similar environment. It is interesting to contemplate the results that would ensue if Germans were substituted for Chinese or the Englishman for the Mexican. When people migrate to a new environment they take with them qualities that may have been acquired through centuries of ethnic experiences. These qualities are brought to bear upon the new environment and, in turn, may be altered considerably. It is probable that the United States people are now undergoing such a change and that the qualities which may cause them to wield a beneficent or a malignant influence in future world affairs are now being evolved. Hence, the stage of human evolution—the human factor—must always be recognized in any geographical study.

Material Progress of a Nation. For our purpose we are considering here a political unit—a nation—that stands as an individual entity among the nations of the world. It has been a land of abundance, of rapid growth in population, of rapid industrial development, and a land in which the stress of overpopulation, with the accompanying era of stringent economy and narrow margin between a comfortable living and poverty, has not yet been felt seriously. This difference in well-being has caused the flow of humanity from the older parts of the world to the newer and chiefly to the United States. In a very short period the material progress of the nation has been phenomenal. Within its bounds live less than 7 per cent of the world's population. However, of the world's production, that relatively small population produces one-third of the coal; one-third of the iron ore and half the steel; more than one-third of the pig iron; about three-fourths of the motor vehicles; more than three-fifths of the petroleum; three-fifths of the Indian corn; two-fifths of the cotton; and similar proportions of several other important products. Of the world's resources and material development, the United States has four-fifths of the coal reserves; a quarter of the iron reserves; more than half the telephone instruments; nearly one-third of the railroad mileage; more than half the radio sets; etc. It has become the leading nation in agriculture, mining, manufacturing, commerce, transportation, wealth, and standard of well-being of its people. Within a large, uncrowded, and richly endowed area, its people have made the greatest progress in material things.

Factors Favoring Material Evolution. What has made possible the great material progress of the United States in such a comparatively short time? Many factors—geographic, economic, ethnic, political—have influenced its growth, chief of which are the following:

1. An area of more than 3,000,000 square miles, which is larger than Australia and about four-fifths as large as all Europe with its multidinous nations each struggling with its environment and with other countries to attain greater opportunities for its people.
2. Great variety of climates, ranging from tropical to cold winters and hot summers, from winter rains, to well-distributed summer rains, from aridity to excessive rainfall, from weather uniformity to frequent changes, from long to short growing seasons, and, on the whole, healthful and invigorating over most of the country.
3. Extensive area of varied soils of high average fertility.
4. Large proportion of lowland plains accessible to the coast; the lesser mountain range on the Atlantic side; few isolated physiographic regions, a condition favoring unity.
5. Abundant, accessible minerals of high quality, especially the more important ones, such as coal, iron, copper, and petroleum.
6. Abundant forests of the most useful types of wood.
7. Long sea coast with numerous good harbors readily accessible to the rich hinterland.
8. Location in the northern midlatitudes across the narrowest major ocean from the progressive nations of Europe, and occupation of the choice section of the North American continent.
9. A population derived chiefly from the north European racial stock, which is noted for its initiative, energy, and intelligence, and which has contributed most to the welfare of the world.
10. A strong, stable government which has fostered and protected individual initiative, general education, and scientific research, aided in industrial development, and protected from invasion.

UTILIZING THE LAND

Agricultural land is probably the most important natural resource that man possesses in that it may provide food and clothing. It was man's desire for new lands, with the greater opportunities for human well-being, that brought European settlers to North America. The first settlers were confronted by a broad expanse of forest-covered terrain, much of which provided poor soils when the forests were cleared away. Production of food under those pioneer conditions was a strenuous task, and even the optimum reward must have been discouraging. Later the tide of migrating man swept on westward to the vast, gently rolling, grassland plains. At first he ignored them, as his ancestral experiences had implanted in him the idea that crops could be produced only on forest land—on land which produced only grass, never! When this erroneous idea was finally abandoned settlement spread rapidly over the fertile, level prairies of the interior; and some of the more hardy souls pressed ever onward to the far Pacific, lured there at first by the gold but later to culivate, to irrigate, to mine, and to harvest the products of the forest and of the sea. Thus, from the primitive agriculture of the early New England farmer on his boulder-strewn and forest-bordered clearing to the far-flung expanse of field on field that now spreads out across the interior plains, and on to the Pacific, has gone man in his effort to produce more and still more. Today those lands, pioneered but a few years ago, are being utilized on a scale never before approximated in the history of the world; yet an *intensive* utilization has been reached in only very limited areas.

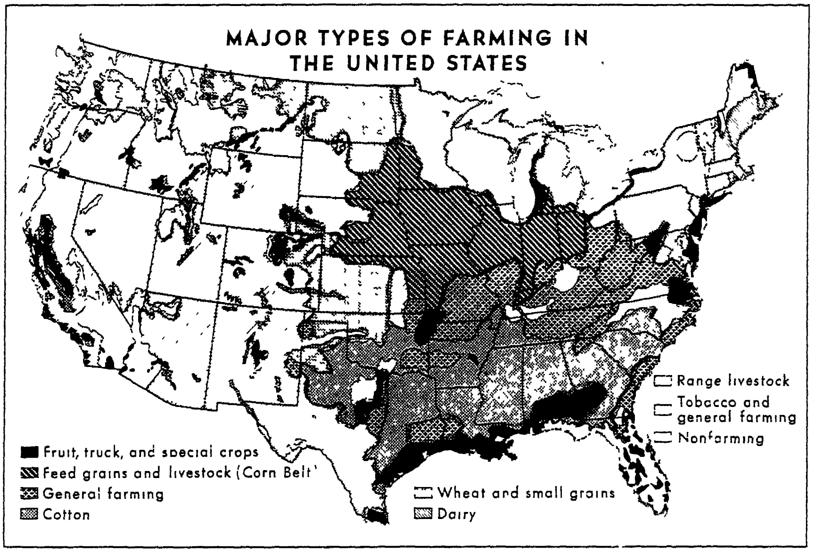

MAJOR TYPES OF FARMING IN THE UNITED STATES
■ Fruit, truck, and special crops
▨ Feed grains and livestock (Corn Belt)
▦ General farming
▩ Cotton
☐ Wheat and small grains
▩ Dairy
☐ Range livestock
☐ Tobacco and general farming
☐ Nonfarming

Fig 11. Types of farming. *Courtesy, Bureau of Agricultural Economics.*

Importance of Agriculture. Agriculture is man's most important industry, because it provides for his fundamental needs. The nation that can feed, clothe, and shelter its people in comfort is as nearly independent as a nation can become. However, man *desires* far more than his mere necessities. To supply his *desires,* he produces for others and builds up a complex system of interchange of products. Many of our largest manufacturing industries, especially those of food and clothing, depend quite as much upon the producer of crops as upon the financier who provides the capital, the miner who supplies coal for power, or the captains of transportation who carry the raw materials and the finished goods. In fact, most of the commercial and industrial prosperity of America is rooted in the land, whether that land is used for crops, grazing, forests, mining, transportation systems, or cities.

Agricultural production in the United States now exceeds that of any other country. Reliable data are not available for major agricultural countries like U.S.S.R., China, India, and Pakistan. However, estimates indicate the value of the products of U.S.S.R. is about three-fourths that of the United States; that of China about half to two-thirds; and that of Pakistan and India combined, less than half. The production of all other countries is small in comparison. The United States is also the leading exporter of agricultural products. The value of its exports since World War II has been larger than that of all other countries combined, yet those exports were only a small part of its production. Of the world's aggregate crop production the United States now produces about 61 per cent of the corn, 40 per cent of the cotton, 35 per cent of the oats, 20 per cent of the wheat, 21 per cent of the flaxseed, 12 per cent of the barley, 6 per cent of the sugar, and 38 per cent of the soybeans. Taking grains alone, it produces about a quarter of the world's total crops. Machine-farming on large acreages, with a minimum of hand labor, great advances in technology of acre yield, seed selection, and processing, has increased production faster than world consumption, and the cultivable land of the United States has not yet reached its productive capacity even by the use of improved methods.

SOILS A BASAL ASSET

The earth's surface is covered by a layer of loose material consisting of sand and clay ranging in thickness from a mere film to many feet. In a few places where rocks outcrop it is absent. This material constitutes what soil specialists call the parent material of the soil. The upper or surface layer of this material is converted into soil, the true soil, by the action of various forces, the most important of which is that of organic life, mainly plant life. It is evident that if the soil is produced by the action of the plant, the plant must begin to grow on the parent soil material before it is converted into soil.

On the basis of important and significant characteristics the soil of the United States may be divided into two great groups, pedalfers and pedocals. In general the soils of the eastern half of the United States are pedalfers and those of the western half are pedocals. The *pedalfers* include all soils in which not only is there no accumulation of calcium carbonate, but also such calcium carbonate as may have been present in the soil material has been entirely removed from the true soil layer by the time the soil becomes well developed. In addition, these soils when well developed have a subsoil that is heavier in texture than the surface soil. They are also more or less acid in reaction. The *pedocals* include all soils which, if they have been well developed as soils, have acquired at some depth or at some level in their vertical section a layer in which calcium carbonate has accumulated in greater proportions than in the layers of the soil above it or in those of the soil material below it. In addition, the surface soils are neutral or alkaline in reaction, or in other words they are not acid. The most important members of the group are dark in color, but some of them may be light.

The soils of each of these major groups may be subdivided into smaller groups in which all members have a number of important characteristics in common. The pedalfers may be subdivided into four well-defined subgroups: (1) Podzols, (2) Gray-Brown Podzolic Soils, (3) Red and Yellow Soils, (4) Prairie Soils. The distribution of the two major groups as well as of the subgroups within the United States is shown on the map, Fig. 12.

Podzol Soils. Podzol Soils in their natural condition, before being cultivated by man, wherever they occur, have developed under a forest cover. The forest trees may be of many kinds, but in most parts of the world they contain at least a mixture of narrow-leafed trees, or conifers. In the forest these soils are covered with a layer of organic matter consisting of leaves, twigs, and other forest debris. This layer may range from a few inches to a foot or more in thickness. It is brown, sometimes quite dark in the lower part, and may be woven together, especially in the lower part, into a kind of mat by fine roots coming up into it from the soil beneath or by filaments of fungi and other plants growing within it. Beneath this layer, which is usually called raw humus, is a layer that ranges in thickness from a very thin film up to a foot or more of gray material which may or may not be mixed with organic matter in the upper inch or two. The lower part may be nearly white. This material is loose and powdery or sandy and, therefore, without what is called structure. This layer is called the podzolized layer. Beneath the light-colored layer lies a brown to dark coffee brown or faint reddish brown layer which may be soft and light in weight or may be indurated into a stonelike body. When indurated it is usually darker in color than when loose. The transi-

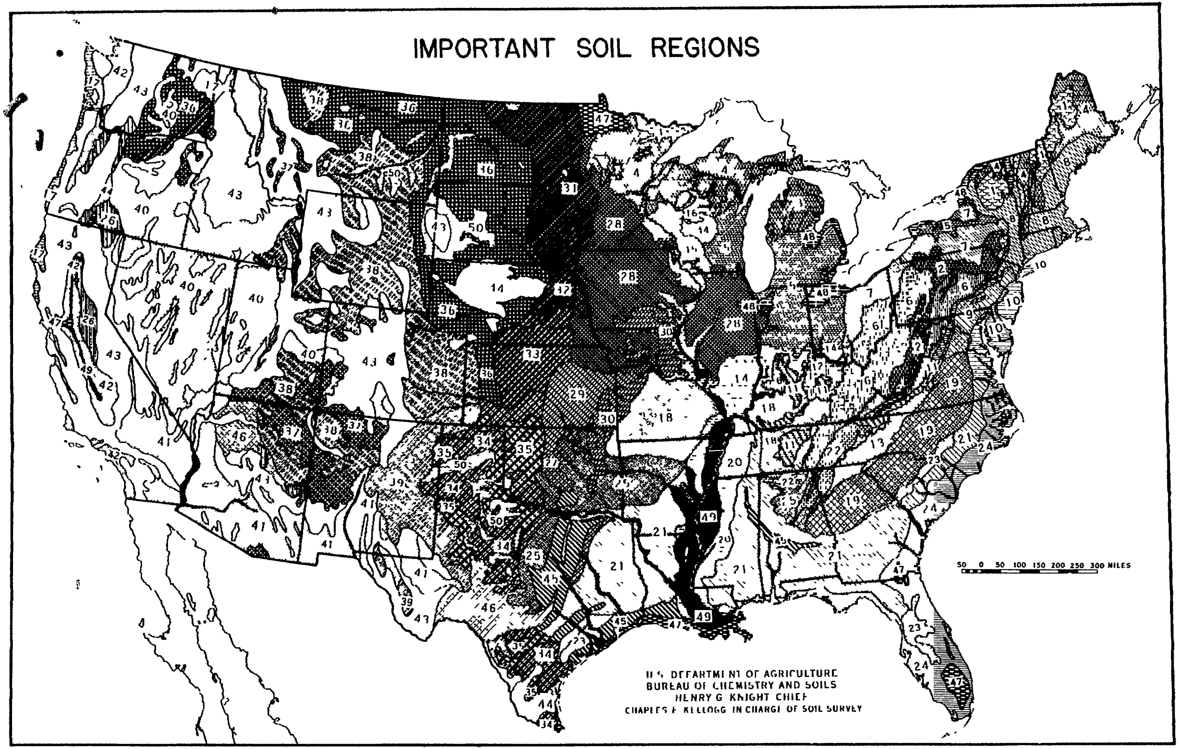

IMPORTANT SOIL REGIONS
U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT CHIEF
CHARLES E. KELLOGG IN CHARGE OF SOIL SURVEY
50 0 50 100 150 200 250 300 MILES

Fig. 12. Soil regions of the United States. *Courtesy, Bureau of Agricultural Economics, Bureau of Plant Industry, Soils, and Agricultural Engineering.* The map is schematic. Each soil region outlined includes associated soils developed under a relatively uniform environment. The names in parentheses refer to the more extensive or representative soil series in the respective regions.

Fig. 12 *(Continued)*

Podzols. The profile consists of a very thin organic layer above a gray leached layer which rests upon a dark-brown or coffee-brown horizon. The Podzol is developed usually under a coniferous forest in a cool moist climate. Its inherent productivity for crop plants is low. The figures below refer to area numbers on the map.

1. Rough stony land, including areas of shallow Podzols.
2. Chiefly loams and silt loams, developed from sandstones and shales of the plateau and mountain uplands. Includes the Leetonia and the Dekalb soils.
3. Dominantly sands and loamy sands, developed on glacial drift. (Roselawn, Kalkaska.)
4. Dominantly loams and clay loams, developed on glacial drift. (Hermon, Ontonagon.)

Gray-Brown Podzolic Soils. The profile has a rather thin organic layer over grayish-brown leached soil which overlies a brown horizon. The soils are generally acid, at least in the surface. These soils develop in a moist and cool-temperate climate under a deciduous forest and are inherently more productive than the Podzols.

5. Dominantly loams and silt loams, developed on calcareous glacial drift. (Miami, Crosby, and Honeoye—Ontario associations.)
6. Brownish yellow silty loams or stony loams with hilly relief developed on sandstones and shales. (Muskingum, Zanesville, Westmoreland.)
7. Loams and silt loams, developed on acid glacial drift, composed of sandstones and shale material. Some of these soils are imperfectly drained. (Canfield, Volusia, Lordstown.)
8. Dominantly stony and gravelly loams, developed on glacial drift. (Gloucester, Troy.)
9. Loams and silt loams, developed mostly on the crystalline rocks of the northern Piedmont. (Chester, Manor, Penn.)
10. Largely sandy loams developed on the sands and clays of the northern Coastal Plain. (Sassafras, Collington.)
11. Chiefly brown silt loams, developed on limestone. (Hagerstown, Maury, Frederick.)
12. Shallow soils developed on interbedded limestone and calcareous shales. (Fairmont, Lowell.)
13. Loams and stony loams from granitic material with hilly to mountainous relief. (Ashe, Porters.)
14. Silt loams with heavy clay subsoils, developed on Illinoian glacial till. (Gibson, Cory, Clermont, Rossmoyne.)
15. Silt loams, developed largely from loess. (Clinton, Fayette.)
16. Imperfectly drained grayish silt loams with silty clay loam subsoils, developed from acid glacial drift. (Spencer.)
17. Largely loams and silt loams with yellowish subsoils, developed from sandstones and shales. (Melbourne.)
18. Grayish yellow to reddish silt loams and cherty silt loams, developed from cherty limestones. (Clarksville, Dickson, Baxter.)

Red and Yellow Soils. This group of soils consists of two general types of profiles which are very intimately associated. Both have thin organic layers. The profile of the Red soil is a yellowish brown leached layer over a red horizon; the profile of the Yellow soil is a grayish-yellow leached layer over a yellow horizon. Both developed under the forest in a moist, warm-temperate climate. Generally the yellow profile

Fig. 12 *(Continued)*

is more pronounced under the coniferous forest and the red under the deciduous forest. The inherent fertility of the Yellow soils is generally relatively low and that of the Red soils, medium.

19. Dominantly brownish red clay loams and gray sandy loams, developed largely from crystalline rocks of the southern piedmont. (Cecil, Durham, Appling, Georgeville, Davidson.)

20. Yellow to light brown silt loams, developed on loess (Memphis, Grenada.)

21. Dominantly gray to yellow sandy and fine sandy loams, with some sands and fine sands, developed from Coastal Plain materials. (Norfolk, Ruston, Orangeburg.)

22. Largely brownish red to red silt loams and clay loams, developed from limestone. (Dewey, Decatur, Fullerton.)

23. Grayish yellow to light brown sands and fine sands of the Coastal Plain. (Norfolk sands.)

24. Grayish fine sandy loams, with some gray or black loams, developed in the flatwoods area of the Coastal Plain. Includes areas underlain by coralline limestone. (Coxville, Leon, Portsmouth.)

25. Grayish yellow to reddish fine sandy loams and silt loams, developed from sandstones and shales A considerable portion is hilly and stony. (Hartsells, Hanceville, Conway.)

26. Red soils of the north Pacific slopes. (Aiken, Sierra, Sites.)

Prairie Soils. The profile of the Prairie Soil grades from a very dark brown or dark grayish brown surface through brown to lighter colored parent material at a depth from 2 to 5 feet. It is developed in a moist temperate climate under a tall-grass prairie. Inherent fertility for crop plants is high.

27. Reddish brown soils of variable texture, developed on sandstones, shales, clays, and sands. (Zaneis, Renfrew.)

28. Dark brown silt loams with yellowish brown subsoils, developed on glacial drift and loess (Carrington, Tama, Clarion, Marshall)

29. Dark brown to reddish brown silt loams and clay loams, developed from limestone and calcareous shales. (Summit, Crawford.)

30. Dark brown or grayish brown silt loams, having heavy subsoils or claypans (Cherokee, Parsons, Grundy, Putnam.)

Northern Chernozem. The profile has a black or dark grayish brown surface soil grading below into light-colored material which is calcareous at 2 to 6 feet. It is developed in a temperate to cool, subhumid climate under tall and mixed grasses. Inherent productivity is high

31 Black loams, silt loams, and clay loams, developed on calcareous glacial drift and associated lacustrine deposits. (Barnes, Bearden, Fargo.)

32. Dark grayish brown loams and silt loams, developed from loess. (Moody, Holdredge.)

33. Dark grayish brown silt loams with claypans developed from loess (Crete, Hastings)

Southern Chernozem—Dark Brown Soils. The profiles have dark brown to reddish brown surface soils underlain by brown or red horizons, grading below into light-colored material which is calcareous at 3 to 6 feet. These soils develop in a warm, subhumid to semiarid climate under a mixed tall- and short-grass prairie

34. Heavy or moderately heavy dark brown soils, developed from calcareous materials. (Pullman, Abilene, Victoria.)

35. Predominantly red and brown sandy loams and sands, developed largely from unconsolidated calcareous sands, silts, and sandy clays. (Amarillo, Miles, Duval)

Northern Dark Brown (Chestnut) Soils. The profile grades from a dark brown surface soil into a whitish calcareous horizon at a depth from 1½ to 3 feet. These soils develop under mixed tall and short grasses in a temperate to cool semiarid climate.

36. Dark brown soils developed on unconsolidated, calcareous sands, silts, and clays. (Scobey, Rosebud, Keith, Walla Walla.)

37. Dark brown soils, developed upon heterogeneous material associated with mountainous and plateau terrain.

Brown Soils. A brown surface soil grading at a depth, ranging from 1 to 2 feet, into a whitish calcareous horizon. The profile is developed in a temperate to cool, semiarid climate under short grasses, bunch grasses, and shrubs.

38. (Northern) chiefly brown loams, developed largely on unconsolidated sands, silts, and clays. (Joplin, Weld.)

39. (Southern) chiefly light brown to gray fine sandy loams to silty clay loams of smooth relief, developed largely on limestone or unconsolidated sands, silts, and clays. (Uvalde, Reagan.)

Sierozem and Desert Soils. Grayish and reddish soils, closely underlain by calcareous material. These soils develop in an arid climate under short grass and desert plants

40. (Northern) gray and grayish brown soils of variable texture, developed largely on loess and alluvial fan material. (Ritzville, Portneuf.)

41. (Southern) gray, brown, and reddish soils of variable texture, developed largely on alluvial fans. (Reeves, Mohave.)

Soils of the Pacific Valleys.

42. Includes a number of variable zonal, azonal, and intrazonal soils which are too intimately associated to separate on a schematic map. These soils are developed under a range of climatic and geological conditions. (San Joaquin, Fresno, Hanford.)

Intrazonal and Azonal Soils. These soils may possess one of two general types of profile (*a*) The profile may express a local condition as drainage or parent material rather than the zonal profile of the region; (*b*) the profile may be too immature to express a zonal type.

43. Rough and mountainous (azonal).

44. Largely azonal sands, some of which are associated with bogs. (Valentine sand, dune sand, etc.)

45. Black (or brown) friable soil underlain by whitish material excessively high in calcium carbonate. These soils develop under a prairie vegetation and are known as Rendzinas (intrazonal). (Houston, Sumter.)

46. Shallow stony soils from limestone (azonal). (Valera, Ector.)

47. Marsh, swamp, and bog (intrazonal). (Carlisle, Pamlico, Rifle.)

48. Soils largely intrazonal, developed upon lake plains. (Brookston, Maumee, Vergennes.)

49. Alluvial soils (azonal). (Huntington, Sharkey, Columbia, Cass.)

50. Rough broken land, including Pierre soils.

tion from the gray to the brown layer is usually quite abrupt. The brown layer is darkest in color at the top and becomes lighter with depth. It ranges in thickness from a few inches to more than a foot.

These soils in the United States develop mainly in regions of cool climate, abundant moisture, a humid atmosphere, and forest vegetation. When cleared and put into cultivation, they are somewhat unproductive because they have been rather thoroughly leached by the heavier rainfall and also because the leaching has been hastened by the organic matter which has been carried down through the surface soil or the gray layer. This organic matter is always acid in reaction and partly because of this tends to rob the gray layer of the materials which produce high productivity in soils. By careful cultivation, the growth of grass, by fertilizers and manures, man is able to change these soils after he begins to cultivate them into good productive soils, more productive than they were in their virgin condition. By the growth of grasses and the grain crops, all of which belong to the grasses as family groups, these soils are improved, provided that man does not take anything away from them. When he removes crops from them, he must supply materials that he has removed, but by adding more than he removes he may easily convert these soils into productive ones.

Gray-Brown Podzolic Soils. Figure 12 shows that the Gray-Brown Podzolic Soils occur in the eastern United States from the Atlantic Coast westward to western Indiana and northern Missouri, and are bounded on the north by the region of Podzols and on the south by the Red and Yellow Soils.

These soils are Podzolic Soils, but they have not been developed as far in podzolization as the true Podzols. In virgin condition they were developed under a forest cover of deciduous trees such as oak, maple, and beech. The surface of these soils is covered by a layer of organic matter which has been derived from the forest leaves and other debris. This layer, however, is not so thick as that overlying the Podzols and is not so thoroughly woven together into a mat or compact layer. It also rarely amounts to more than 3 inches in thickness, most of which consists of loose material. It is underlaid by a thin dark-colored layer of mineral soil which may or may not be present in the Podzols. The thin dark-colored layer, usually 3 inches or less in thickness, is underlaid by a pale yellowish or light brown layer, corresponding to the gray layer in the Podzols.

In virgin condition these soils are more productive than the Podzols, partly because they are less acid and partly because they have been leached of their constituents less than the Podzols. In that part of the region of Gray-Brown Podzolic Soils lying west of the Alleghenies and also in considerable areas east of the Alleghenies, these soils have developed from limestone materials, but even in such cases they have become relatively poor soils because they have been podzolized, though not converted into true Podzols. They also are acid in reaction regardless of their development from limestone material. They are more productive, however, than the surrounding Gray-Brown Podzolic Soils developed from materials which do not contain lime.

These soils are more productive than the Podzols and may be easily converted into productive soils by proper management. The most important factors in their management are the growth of grass and the application of manures and fertilizers. These soils like the Podzols have a low content of nitrogen, phosphoric acid, lime, and potash—or, in other words, practically all the constituents required for high productivity in a soil—but the deeper material contains higher percentages of these constituents; and, when grass is grown on them, this material is brought in greater or less extent upward and stored in the surface soil. When the growth of grass is aided by the application of fertilizers, productivity is greatly improved.

Red and Yellow Soils. The southeastern part of the United States is covered by a group of soils which is designated as Red and Yellow Soils, or more properly as the Red and Yellow Podzolic Soils. They have a section or profile, as we usually say, very much like that of the Gray-Brown Podzolic Soils. The surface layer is light in color, and the subsoil is stronger in color and heavier in texture; or, in other words, it has more clay. The surface soil is generally yellowish and the subsoil deeper yellowish-brown or red. Whether it is yellowish-brown or red depends partly upon the character of the material from which the soil developed and partly on the drainage of the soil.

These soils have been more thoroughly leached of their lime, potash, soda, and phosphoric acid and also of their organic matter than have the other Podzolic Soils. They have, therefore, a very low content of these constituents and to that extent are less productive in their natural condition than the other soils described. Because of their sandy texture, however, they warm up in the spring very early, they are easily cultivated, and they will absorb the rainfall to a greater extent than the other soils. Because of their sandy clay subsoils, they will hold a considerable amount of moisture and allow plant roots to develop in them thoroughly and obtain this moisture. Their physical characteristics, therefore, so far as they depend on the texture of the soil material, are favorable to production of many crops and especially of cotton. When fertilized or manured they may be converted into highly productive soils, but they require more fertilizers and manures than the soils of either of the two groups already described. They are somewhat too sandy over considerable areas, though not everywhere, for the luxuriant growth of grass, and they do not have a rich supply of organic matter which favors a high production of corn. The climate is too warm also for the growth of wheat and barley, but oats may be grown in winter. The climate favors the growth of cotton, however, if fertilizer is used, and many of the important forage crops when grown with fertilizers may be produced in good quantities.

Prairie Soils. The Prairie Soils occur in the central part of the United States as shown by Fig. 12. They are dark in color, the best of them being black. The black layer ranges in thickness from 6 to 8 inches up to 2 feet or slightly more. The surface soil is usually as heavy in texture as the subsoil, differing in this respect, therefore, from all groups of the Podzolic Soils. No clay material or lime or other constituent in any important quantity has been taken out of the surface soil and into the subsoil, as in the Podzolic Soils. In considerable areas, to be sure, this has taken place in the Prairie Soils, but such Prairie Soils are designated as degraded Prairie Soils; or, in other words, they have begun to be podzolized. The true Prairie Soils, however, are not podzolized and, therefore, have not been leached extensively of ~~their materials~~. They have a fair-to-good supply of all the constituents which bring about high productivity in soils. The climate in which they occur also has abundant rainfall and sufficiently long growing season to produce good yields of the grain crops. They may be described as simple soils so far as the processes of development are concerned. Nothing has happened to them except the accumulation of a large amount of organic matter which gives them their dark color.

This organic matter supplies them with a high percentage of nitrogen, when that has been released by proper decomposition, which promotes high productivity. The presence of this organic matter and also of a good percentage of lime which has combined with the organic matter that holds it in place and bars leaching by water has given these soils a good structure. They are granular in structure, as we usually say; or, stated in another way, they are friable and have a good crumbly structure, and when cultivated can be brought into good tilth readily.

These soils are highly productive for most of the grain crops, and especially for corn and oats. They are productive also for grass and for such crops as alfalfa and clover and many of the forage crops. They are not so productive for tree fruits, such as apples and peaches and pears, as the lighter-colored soils, because they were not developed under a forest cover and, therefore, many kinds of trees do not grow so well on them as on the better of the Podzolic Soils. They are, however, highly productive agricultural soils and do not require the use of fertilizers in order to produce fair-to-good crops. Even the poorer soils, those in which podzolization has begun, are more productive than any of the Podzolic Soils.

Chernozem Soils. The soils so far described constitute the members of the pedalfer group. The Chernozem Soils constitute one of the groups of the *pedocals.* The Chernozem Soils are typically black. They are even blacker than the Prairie Soils. In the United States these soils, as shown by the map, occur in a belt running from north to south. They occur also in Canada in a belt which runs northwestward from the northern part of the United States. In Canada and in the northern part of the United States,these soils are black. As we come southward in the United States they become less black but still have a very dark color well into the High Plains region of Texas and a dark brown color southward to their southern limit on the coast of the Gulf of Mexico. In the soil section they are very much like the Prairie Soils, except that in the subsoil there is a layer which contains a very high percentage of calcium carbonate; sometimes this is mixed with other salts like gypsum and various small percentages of salt which are usually designated as alkali salts. However, these salts do not usually occur in the Chernozem Soils in sufficient amount to interfere with the growth of plants. Where gypsum occurs, it generally lies below the layer of maximum calcium carbonate accumulation. Normally the surface soils do not have calcium carbonate, but they are not poor in lime. Like the best of the Prairie Soils, these soils contain enough lime to combine with the organic matter and hold it in place, preventing it from being taken out in solution by rainfall. They also have a highly granular structure in the surface soil, causing them to work well under cultivation. The rainfall of the area in which they are found is somewhat low, however, for maximum crop production, and severe droughts occur at times. They are productive for wheat and other small grain crops, especially barley, the quality of the grain being very high. In the United States and in other parts of the world where they occur, they produce most of the wheat that enters into the international wheat trade of the world. They are not highly productive for corn; not because the soils are not good for corn but because the moisture supply is not sufficient for that plant. They are productive soils for grass, however. In the southern part of the belt in which they occur, they are productive soils for cotton. When the rainfall is high, they produce large crops without the use of fertilizers; when the rainfall is low, they will not produce large crops even with fertilizers.

Dark Brown Soils. West of the belt of Chernozem Soils lies a belt of Dark Brown Soils. Aside from their dark brown rather than black color, they are very much like the Chernozem Soils in their characteristics.

They differ, however, from the Chernozem Soils in having a less thick dark-colored layer which in the Chernozem may range up to 2 or 3 feet. In the Dark Brown Soils this layer is rarely more than 1 foot in thickness. These soils, however, are granular in structure like the Chernozem Soils. They have a good supply of calcium, which permits organic matter to stay in the soil rather than to be leached out, and the supply of organic matter is large enough to furnish a fair to good supply of nitrogen as it decomposes. Like the Chernozem and the best of the Prairie Soils, the iron and alumina and clay have not been taken out of the surface soil and carried into the subsoil. In some places where it is thought that the climate has become more moist than formerly, the Chernozem Soils have become degraded, as it is often described; or, in other words, they have become slightly podzolized like the Prairie Soils. In rare cases or possibly never have the Dark Brown Soils been podzolized.

The Dark Brown Soils are adapted to the growth of wheat, barley, and grass, but are less productive, not because they are less fertile, but because they have a lower moisture supply than the Chernozem Soils. They can be used, nevertheless, for the production of wheat and barley if the moisture supply is conserved. The region in which they occur, however, is subjected to droughts, and the farmers on them must take into consideration the possibility of such occurrences at relatively frequent intervals.

Brown Soils. West of the belt of Dark Brown Soils is a belt of Brown Soils, lying along the foot of the Rocky Mountains and extending eastward to the western edge of the Dark Brown Soils. The area of distribution is shown on Fig. 12. These soils, like the Dark Brown Soils, the Chernozems, and the Prairie Soils, developed also under a grass cover, but the cover was not so dense as in the other soils nor did it cover the surface of the ground in a continuous sod or grass cover. The grass was distributed in bunchlike areas, although it was not a typical "bunchgrass." The grass growing on these soils is a short grass similar to that growing on the Dark Brown Soils, but it has been too light to supply as much organic matter in the surface soils as is found in the Dark Brown Soils.

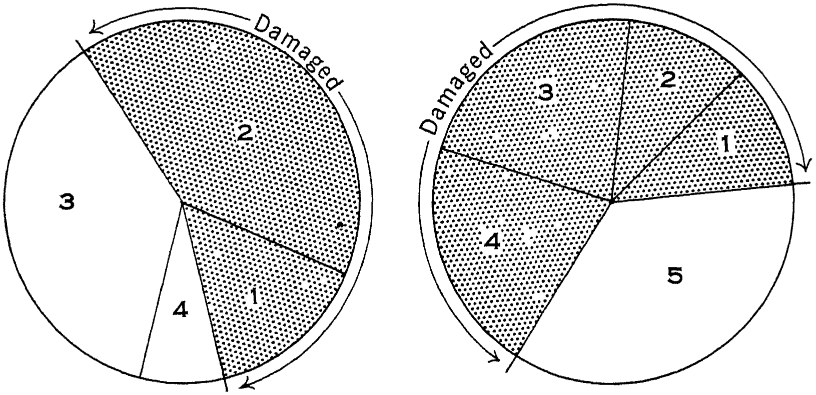
On the surface there is a thin layer, usually from a fraction of an inch to 3 inches in thickness, of loose, usually sandy, material. It is light in color. This is underlaid by a firm, claylike, brown material, which breaks into clodlike masses, but is soft and friable when moist. This layer ranges up to a foot in thickness but is usually somewhat less. The lower part of this layer contains a high percentage of calcium carbonate identical with the layer in the Dark Brown Soils and the Chernozem. Beneath the layer of accumulated calcium carbonate is a parent material which may vary in character depending upon the character of the underlying geological formation. These soils contain high percentages of the constituents of soil productivity except nitrogen, and a moderate percentage of that constituent. They do not have a granular structure like the Prairie, Chernozem, or Dark Brown Soils. They are highly productive soils under irrigation but are not good for dry farming. They occur mostly in regions where the rainfall is insufficient for growing crops without irrigation and where there is only a relatively small amount of water for irrigation purposes. They are, however, irrigated in Colorado along the Platte River and certain other streams, also in western Nebraska, Wyoming, Montana, and various other places in the West, but organic matter added by growing crops that will enhance it, or in some other way, is advantageous.

Gray Soils. In the desert part of the United States the soils are designated as Gray Soils. They are very light in color because of the low percentage of organic matter which they contain. The low percentage of organic matter is due to the absence of a grass cover. They developed under a thin cover of scattered bushes, and this kind of vegetation does not add organic matter to the soils. The surface soil is often gravelly, but not too gravelly for cultivation. There is a thin layer of loose material like that overlying the surface of the Brown Soils. Beneath the loose material is a firm layer, grayish, or, in the southwestern part of the United States, slightly reddish in color. It is similar to the corresponding layer in the Brown Soils but contains less organic matter. The same layer may contain calcium carbonate in considerable quantities, and the lower part of the layer contains high percentages. In other words, the zone or layer of calcium carbonate accumulation lies close to the surface in these soils.

These soils are productive for crops under irrigation but cannot be used for dry farming. The percentage of organic matter, as already stated, is low, but what is present decomposes and delivers its nitrogen to the soil rather rapidly. If the method of cultivation under irrigation provides for the restoration of organic matter, these soils may be used for a long time without fertilizers other than such as are added in roots of plants or by plowing under organic matter of any form.

THE PROBLEM OF SOIL EROSION

In the preceding discussion we have seen the rapid expansion of agriculture in the United States and the vast acreage of highly fertile soils available for man's utilization. Thus far only one thought has guided the exploitation of its agricultural land, *viz.*, to get more land under cultivation so as to produce bigger and bigger crops. The people have assumed that soils were inexhaustible and that the United States had an abundance of good land for every person who wanted to cultivate it. The expressions, "It will last as long as I want it" and "There is plenty more," are typical of the sentiment that has prevailed. The careless waste of cultivable land has been similar to the waste of many other natural resources. It is probable that such an attitude is the reaction of a people to a new land endowed with rich natural resources that appeared to them as limitless. However, the time has come when not only must soil erosion be stopped but reclamation of eroded lands must also become a fixed policy. Destructive methods have already ruined, or severely damaged, 100,000,000 acres of good cropland and removed half to all the topsoil from another 100,000,000. See Fig. 13. Soil studies thus far made show that under some conditions of soil, slope, and cultivation as much as 7 inches of soil are removed in 8 years, and that twenty-one times as much plant food is removed from the soils of the country annually as is used by the growing crops. Many of these huge annual losses can and must be prevented.



A. Extent of Erosion in Total Area Damaged
1. Ruined or nearly ruined—14.8%
2. Erosion moderate or started—40.7%

Not Damaged
3. Grassland, forest, marsh, swamp, etc.—36.8%
4. Mountains, deserts, etc.—7.6%

B. Erosion Damage to Cropland
1. Ruined for cultivation—10.8%
2. Damaged severely—10.8%
3. Half or all of topsoil removed—21.7%
4. Erosion started—21.7%
5. In good condition—35%

Fig. 13. The problem of soil erosion. Out of our total area (*A*) of 1,905,000,000 acres, approximately 1,057,000,000 acres have been ruined or damaged by erosion. Of our good cropland of 460,000,000 acres, some 300,000,000 acres are ruined or damaged.

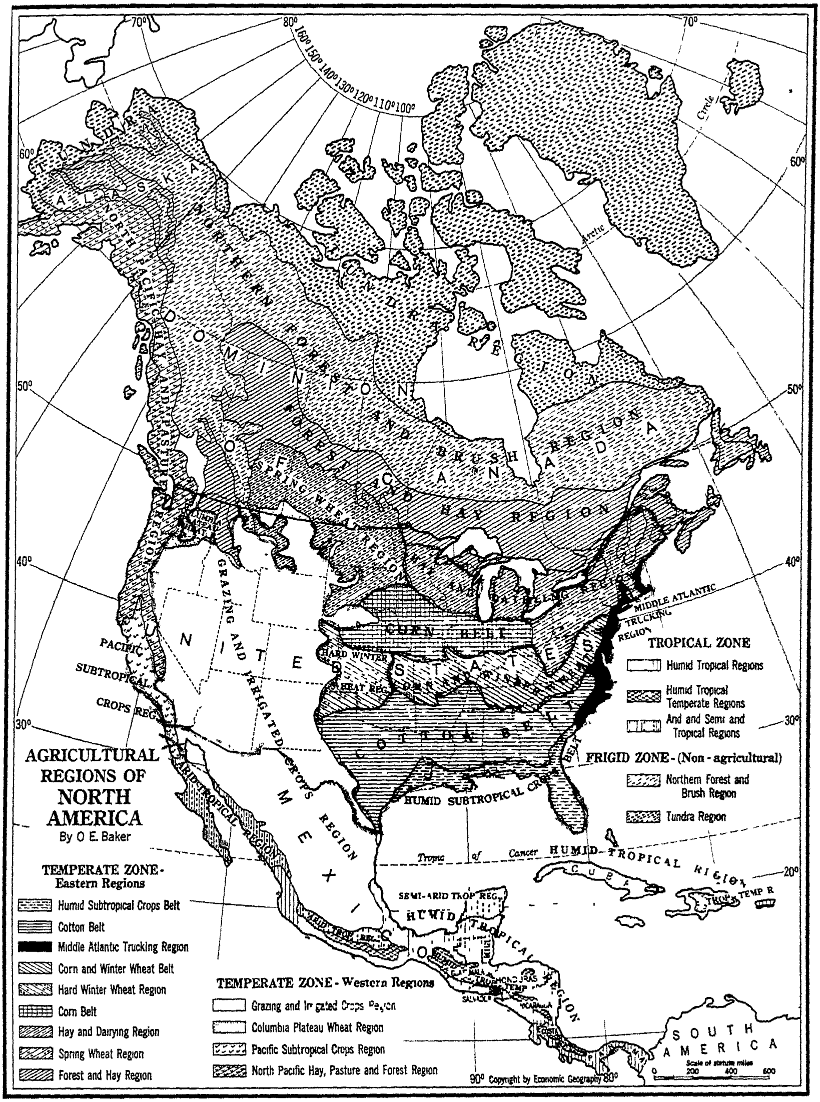

AGRICULTURAL REGIONS OF NORTH AMERICA
By O E. Baker
TEMPERATE ZONE - Eastern Regions
Humid Subtropical Crops Belt
Cotton Belt
Middle Atlantic Trucking Region
Corn and Winter Wheat Belt
Hard Winter Wheat Region
Corn Belt
Hay and Dairying Region
Spring Wheat Region
Forest and Hay Region
TEMPERATE ZONE - Western Regions
Grazing and Irrigated Crops Region
Columbia Plateau Wheat Region
Pacific Subtropical Crops Region
North Pacific Hay, Pasture and Forest Region
TROPICAL ZONE
Humid Tropical Regions
Humid Tropical Temperate Regions
Arid and Semi arid Tropical Regions
FRIGID ZONE - (Non - agricultural)
Northern Forest and Brush Region
Tundra Region
ALASKA
NORTH PACIFIC HAY AND PASTURE REGION
NORTHERN FOREST AND BRUSH REGION
TUNDRA REGION
DOMINION OF CANADA
FOREST AND HAY REGION
SPRING WHEAT REGION
HAY AND DAIRYING REGION
CORN BELT
HARD WINTER WHEAT REGION
CORN AND WINTER WHEAT BELT
COTTON BELT
HUMID SUBTROPICAL CROPS BELT
MIDDLE ATLANTIC TRUCKING REGION
UNITED STATES
GRAZING AND IRRIGATED CROPS REGION
PACIFIC SUBTROPICAL CROPS REGION
MEXICO
SEMI-ARID TROP. REG.
HUMID TROPICAL REGION
HUMID TROPICAL REGION
CUBA
SOUTH AMERICA
Tropic of Cancer
Arctic Circle
70° 80° 160° 150° 140° 130° 120° 110° 100° 70° 60° 50° 40° 30° 20° 90° 80°
Scale of statute miles 0 200 400 600
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Fig. 14. Agricultural regions of North America. The United States is divided into a humid eastern half and an arid or semiarid western half except for the higher mountain elevations and the North Pacific Coast. Each subdivision or region is characterized by a distinctive crop system or crop combination due primarily to climatic differences In the humid East these regions have been determined by a leading crop, except for the subtropical coast where climate and low wet lands are determinants. In the drier West the names reflect the strong climatic influence of topography and of the Pacific Ocean. *Courtesy, O. E. Baker and* Economic Geography.

Fortunately, great progress in soil conservation has been and is being made. Continued cooperation of government and farmer can solve the problem.

AGRICULTURAL REGIONS[1]

It is axiomatic that not all land is equally suited to the raising of the same crop. In an area as large as that of the United States and located in midlatitude, divergence in agricultural and pastoral industries is to be expected. Many factors determine the differences that now exist or may develop in such a large area. Among the more important geographic factors are (1) climatic differences, (2) varying proximity to markets, (3) topographic differences, and (4) differences in the chemical and physical characteristics of the soil. The influence of factor 4 is most striking in small areas such as a township or county, and the influence of the others in larger areas. See Fig. 14.

Other significant factors that may exercise a controlling influence in some areas include government subsidies, tariffs, introduction of new crops and development of more favored competing areas, more efficient methods of farming and marketing, and new types of machinery such as the combine, harvester, and cotton-picking machine. An interesting current example is the rapid spread of the soybean and machinery for handling the crop. This new crop is now crowding cotton in the Delta region of southeastern Missouri where handpicking still prevails and where large soybean mills are well established.

The East vs. the West. In general, the United States is divided about equally into an eastern humid half, characterized by the cultivation of grains, tame hay and pasture, and the production of shelter-fed livestock; and an arid or semiarid western half, characterized by wild hay, pasture and grazing, irrigation, dry farming, and very limited humid-type agriculture. Local sections in California, the north Pacific Coast and the northern Rocky Mountains are exceptions, but they are relatively small. The transition belt between the eastern and western halves corresponds approximately to the 100th meridian West and to an average annual rainfall of 25 inches in southern Texas and 15 inches along the Dakota-Canadian border. The agricultural regions in the eastern humid half extend, in the main, east and west, corresponding closely to latitude, and are determined chiefly by temperature and the leading crop. Those of the western arid and semiarid half extend north and south and are based primarily upon the rainfall, topography, altitude, and soils. The eastern humid half produces fully 85 per cent of the total value of all crops and has a like proportion of the crop acreage. In the East "corn is king," and in the West hay is the leading crop, though forage secured by grazing nearly equals it in value. More than five-sixths of the land in crops is in the eastern humid half of the country, and nearly two-thirds is in the triangular-shaped area extending from eastern Ohio to north central North Dakota and central Texas. This triangular region includes only about a quarter of the area of the country, yet it produces three-fifths of the hay, four-fifths of the corn, and three-fourths of the wheat and oats. No similar area of the world offers equally favorable conditions for corn culture, and it is probable that few, if any, other regions are as suitable for the production of small grains and hay.

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[1] For a more detailed discussion of agriculture, see Chapters 5, 8, 12, and 16.

The Arid and Semiarid West. This extensive area of scant precipitation is a land of high mountains and plateaus and has an average elevation of more than 4000 feet; hence altitude, scant rainfall, and soils are the principal factors determining its subdivision into agricultural regions. Except in the humid north Pacific region, and in the irrigated and dry-farming sections, 2000–4000 acres are needed to support a family. In the irrigated sections 80–120 acres are required, and in the dry-farming sections 640 acres or more. The total value of all the crops of this area forms only a small fraction of the total for the United States. The current character of the agriculture is shown by the fact that hay and forage constitute more than a quarter of the value of the crops; wheat, and fruits and nuts about a fifth each; with much smaller proportions for vegetables, oats, and barley. More than three-fifths of the crop acreage is in the Great Plains regions of dry farming and grazing.

The scant rainfall throughout nearly the whole area limits most of this area to the grazing industry. From the western Dakotas, Nebraska, and Texas to the Pacific Coast are more than 700 million acres of range land. Other important range areas occur in central Texas, in the Flint Hills of Oklahoma and Kansas, and in the Arbuckle Mountains of Oklahoma. Sheep are raised in the more arid and cattle in the less arid sections. In areas of seasonal grazing sheep are commonly moved to the foothills in spring and fall and to the mountains in summer. Cattle are likewise grazed during the summer in the mountain ranges, pastured on hay or cropland on spring-fall range, and fed during the winter months. Here are produced about two-thirds of the sheep of the United States and more than a quarter of the cattle. Goats are the major livestock on the brush-covered, rough range of the Edwards Plateau of Texas. In the cool, moist north Pacific region, dairying is the most important livestock industry. In the vast mountain and plateau country between the north Pacific Coast and the Great Plains, grazing is likely to remain the leading activity.

Much of the region provides only scanty pasturage, as it is so dry that 50–100 or more acres are required to maintain one steer. Crop production on an intensive scale is impossible except by irrigation, and because of insufficient water only a very small fraction of this area can ever be irrigated. Approximately 20,400,000 acres are now irrigated in the entire West, and more than half of this area is in California, Colorado, and Idaho. These three states also have half of the undeveloped irrigable acreage for which water is available in present irrigation systems. Projects under development will increase the irrigated acreage in the arid areas. In some sections feed production by irrigation and livestock grazing on the dry lands has been coordinated.

Dry farming appears to offer limited possibilities in competition with the humid East. At most, it is an effort to make the best of an unfavorable climate. It consists essentially of cultivating semiarid lands in such a manner as to accumulate and conserve the moisture received during 1 or more years, and taking a chance that there will be sufficient moisture to produce a crop once in 2 or 3 years. If conditions prove favorable, profit may result, as the land is relatively cheap and the investment small. Thus far, it has proved disappointing in the solution of dry-land problems, and as a means of providing for a large agricultural population it is not promising.

The Spring-Wheat Region. This nearly flat to gently rolling area with fertile black soils, within which lies the famous Red River Valley, is characterized (1) by spring-grown cereals—wheat, oats, barley, flax—with wheat as the dominant grain, and (2) by an extensive type of agriculture. Most of its products are shipped to distant markets, and very little is consumed on the farm where grown. Livestock and cultivated hays are relatively unimportant, though corn for forage and the dairy industry are now entering the region. Fields of corn may now be seen in the northern stronghold of spring wheat. The potato and soybean are crops rapidly growing in favor and competing with spring-grown cereals. Little spring wheat is grown outside this area. Its crop constitutes more than 20 per cent of the total wheat crop of the United States, and more than 85 per cent of the spring wheat. More than four-fifths of the area is in farms; nearly seven-tenths is improved, and more than half is in crops. About half the spring-wheat acreage of the United States is in the Spring-Wheat Region, where two-fifths of the crop acreage is devoted to its culture, and most of the remainder is in the adjoining Great Plains region. Nearly nine-tenths of the total crop of North America is produced in the Canadian and United States sections of this area. A lesser but important producing center is located in the subhumid sections of Washington and Oregon. The principal factors in evolving the distinguishing type of agriculture in this region have been (1) the low rainfall of 15–25 inches, coming chiefly in the spring and summer; (2) long, cold winters of comparative idleness; (3) short, hot summers favorable to ripening and harvesting of grains; (4) fertile prairie soils; and (5) the distant consuming markets.

The Hay and Dairying Region. This northern region, extending from Minnesota to Maine, with its cool, moist summers, its poorly drained podzolic glacial soils and many swamps, and its relatively large proportion of rough lands, is preeminently a land of hay, pasturage, and silage of high quality. Half or more of the improved land in nearly every county of the region produces these crops. Less than a third of the area is improved, and only about a fifth is devoted to crops. The large production of hay and the excellent pasturage are the bases for a well-developed dairy industry which finds a ready market for its milk, butter, and cheese in the scores of large cities within or adjacent to the region. Near urban centers the major product is fluid milk; butter and cheese predominate at greater distances from market. Much of the grain and other concentrates which comprise a part of the heavy feed ration are produced on the dairy farms, but large quantities are imported from other regions. Other crops, such as fruits, sugar beets, potatoes, beans, corn, and small grains, occupy a leading position in local districts but are relatively small factors in the agricultural economy of the region as a whole.

On the northern margin is an extensive deforested area, parts of which are suited to agriculture and are being settled slowly. However, much of this section is best suited to the growth of forests and should be used for that purpose.

The Corn Belt. The Corn Belt probably produces more food to the square mile than any area of like extent in the world. More than nine-tenths of its area is in farms, more than three-fourths is improved, and more than three-fifths is in crops. The warm, moist climate and rich prairie soils make the region peculiarly well adapted to corn and associated meat production. Nearly two-fifths of the crop acreage is devoted to that cereal, and the annual crop contributes half the value of all crops. More than half the corn crop of the United States is produced in this region, and it is also the center of the beef-cattle and hog-raising industries, where about a quarter of the cattle and more than two-fifths of the hogs are produced or got ready for market. Other important crops are hay, oats, soybeans, and wheat, which provide a desirable system of rotation—hay and oats along the northern margin and hay and wheat along the southern. Abundant spring and summer rains, a long, warm growing season, and great extent of exceedingly rich dark brown silt loams spread over a level or gently undulating plain are the basal geographic factors that have contributed toward making the Corn Belt a superior agricultural region. The stage of general prosperity and progress of its farming people is indicated by the widespread use of modern conveniences such as the automobile and telephone. The fine homes with grass-covered lawns, large, well-kept barns and outbuildings, fields of excellent crops enclosed by wire fences, herds of high-grade domestic animals, farm machinery, hard-surfaced highways, railroads, telephone lines, motor vehicles make up a striking cultural landscape. From 60 to 90 per cent of the farms have telephones; many have radio-receiving sets; one-half to three-fourths of the farms have automobiles; and two-fifths of the total number of automobiles on farms in the United States are in the Corn Belt. A similar ratio holds in the use of modern farm machinery. All this reflects the tendency of the United States farmer to utilize modern mechanical equipment, and the degree of rural progress and prosperity attained.

Corn and Winter-Wheat Belt. On the south the Corn Belt blends into the Corn and Winter-Wheat Belt and the Hard Winter-Wheat Region with no sharp line of demarcation. The three regions have more than seven-tenths of the winter-wheat acreage of the United States, nearly half being in the second and third. The Hard Winter-Wheat Region of western Kansas, Oklahoma, Texas, and eastern Colorado is by far the more important. Growing wheat on a large scale is the major farm enterprise, but there is a large total acreage of sorghums. Other minor crops include barley, oats, alfalfa, and sweet clover in the eastern portion and on the flat lands along the streams. The northern limit of winter wheat corresponds in general with the mean winter isotherm of 20°, and its southern limit with the mean isotherm of 72° for the month just before harvest. Though winter wheat occupies about 30 per cent of the crop acreage in the Corn and Winter-Wheat Belt, corn exceeds it in value. Cattle and swine are also produced in large numbers, but they are relatively less important than in the Corn Belt.

The Cotton Belt. Cotton is king of crops in the Cotton Belt, and corn is the leading cereal. More than two-fifths of the cropped land is devoted to cotton culture—this is a region where only about a fourth of the entire area produces cultivated crops of any kind. However, the intensity of cotton culture varies greatly within the Cotton Belt. In some specialized areas a third to more than half the farm land may be devoted to cotton, such as the Delta areas of Louisiana, Mississippi, Missouri, and Arkansas; and the Corpus Christi and High Plains areas of Texas. In other sections little cotton is grown, or it is grown as part of a more general type of farming economy which may include peanuts, tobacco, pasture, livestock, and dairying. The only other cotton-producing areas that may be considered of importance are found in the irrigated lands of California, New Mexico, and Arizona. Unlike corn, cotton is distinctly a cash crop, and all except part of the seed leaves the farm upon which it is grown. Prosperity, therefore, soars or wanes with the price of cotton and size of the crop. As noted, very little cotton is grown in the United States outside of this belt. Its northern limit has 200 frost-free days and a mean summer temperature of 77°; the southern limit has 11 inches of autumn rainfall—more than that amount injures the lint and seriously interferes with picking. Scant rainfall limits cotton growth on the west, except by irrigation. Cotton is grown on all well-drained types of soil, but the larger crops are produced in normal years upon the dark-colored clay lands, especially those rich in lime, and upon the red, brown, and black bottom lands. Both the climate and the soil of the Cotton Belt are particularly well suited to the growth of cotton and are the principal geographic factors that have made this the world's largest cotton region, and cotton the largest commercial crop of the United States and a large export commodity. Other factors favoring the extensive culture of cotton are (1) a large world demand and limited areas favorable to its culture, (2) the fact that cotton growing provides employment from early spring to early winter, (3) the fact that the crop is sold directly for cash instead of indirectly through livestock as is corn, and (4) mechanization of production.

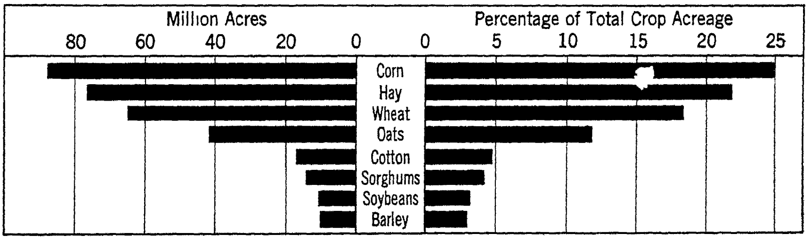

Fig. 15. Principal Crops of the United States. These eight crops occupy nine-tenths of the acreage of all crops. The United States produces about three-fifths of the world's corn, more than two-fifths of the cotton, more than one-third of the oats and soybeans, and one-fifth of the wheat.

Subtropical Coast. This hot, moist coastal lowland region extends from South Carolina to Texas. The warm winds from the warm Gulf of Mexico and oceanic waters exercise a controlling influence on its climate and agriculture. It is characterized by a subtropical climate, sandy soils, and extensive areas of poorly drained land, rather than by any leading product. Agriculture is subtropical in character and varies from growing of rice, sugar cane, winter vegetables, and citrus fruits to cattle ranching. Only about a fifth of the area is in farms, only 8 per cent is improved, and only 6 per cent produces crops.

Cropped Land and Leading Crops. The acreage devoted to crops is an index of the distribution of agriculture. Though crops are produced throughout the humid eastern half of the United States where five-sixths of the crop acreage is located, the north central section is by far the most important. The triangular section lying between north central North Dakota, central Texas, and eastern Ohio contains nearly two-thirds of the cropped land, and, though it embraces only about a quarter of the United States, it produces four-fifths of the corn, three-fourths of the wheat and oats, and three-fifths of the hay. Cotton is the only other important crop produced outside this section, whose geographic advantages for the growth of small grains and hay are equaled by few other parts of the world. It is superior to any other equal area for the production of corn.

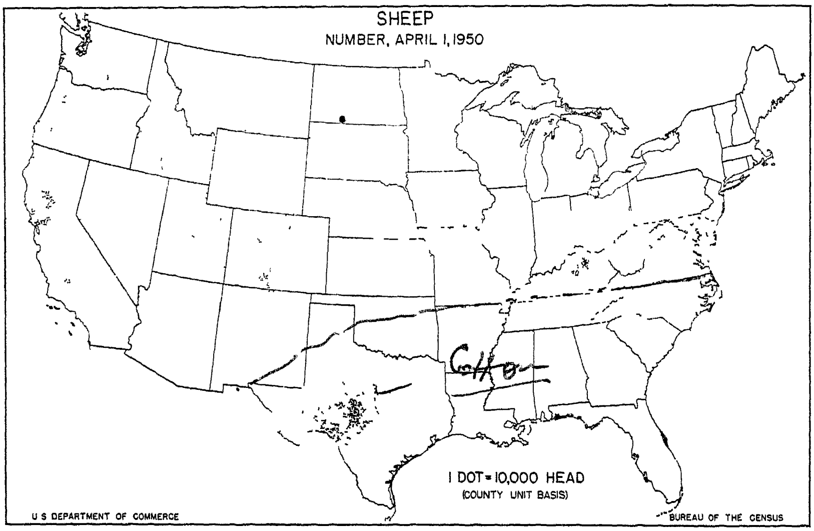

Fig. 16. More than three-fifths of the sheep are in the West, largely because they can graze on arid lands better than any other domestic animal, and also because they are less subject to disease in arid climates than in humid.

Corn, hay, wheat, oats, cotton, sorghums, soybeans, and barley are the principal crops of the United States (Fig. 15). These crops occupy more than nine-tenths of the acreage and constitute nearly seven-tenths of the value of all crops produced. They also constitute a large proportion of the world's production.

Livestock. The production of livestock is a major phase of American agriculture. About two-thirds of the crop acreage produces food for domestic animals, and, in addition, more than 149 million acres of plowable land and 940,000,000 acres of non-plowable land, public lands, and forest lands, are used for this purpose. Domestic animals consume essentially all the feed produced on unimproved land, two-thirds of that on improved land, and fully four-fifths of all that produced by wild and tame vegetation in the country. The humid East produces most of the food and most of the cattle and swine; the drier lands of the West produce most of the sheep. Cattle are more evenly distributed than either swine or sheep, being most abundant in the Corn Belt, the Hay and Pasture Region, and the Corn and Winter-Wheat Belt. Swine are intimately associated with the production of abundant fattening food, hence two-

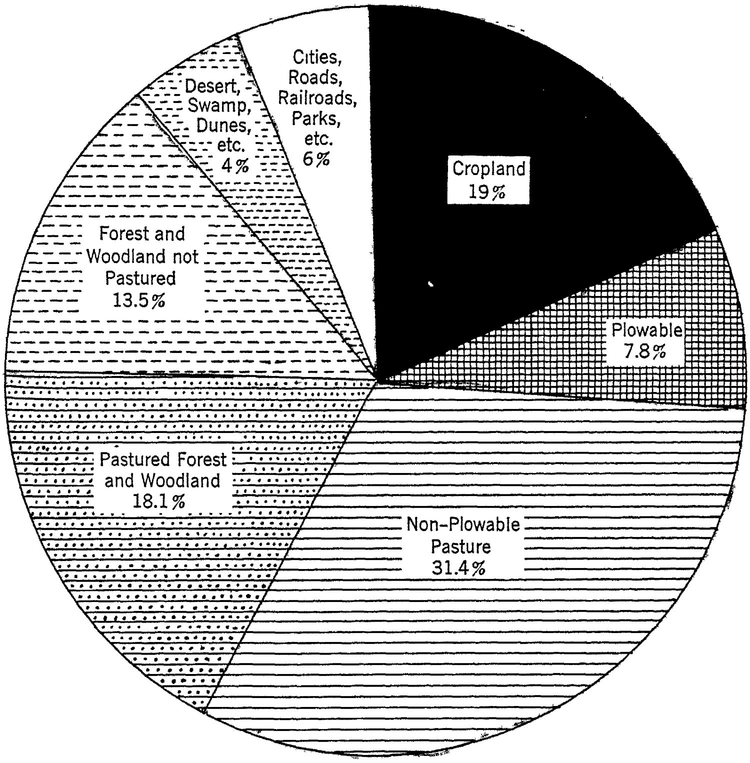

Fig. 17. Use of land in the United States. The total land area of the United States is 1,905,000,000 acres. Approximately 19 per cent of the land area is used for crops; about 40 per cent for pasture and grazing exclusive of pastured forest land; and 32 per cent is in forest and cut-over land, more than half of which is used for pasture. The area of the pasture land physically suitable for crops is less than half as large as the present cropland, but it is poorer land and cannot be used for crops under present economic conditions.

fifths are in the Corn Belt and another fifth in the Corn and Winter-Wheat Belt. Sheep are better adapted to the rougher and more arid lands than are other domestic animals; they can go for days or even weeks without water when the pasture is succulent; they can be handled in large bands owing to their herding instinct; hence three-fifths are raised in the western half of the United States. (Fig. 16.)

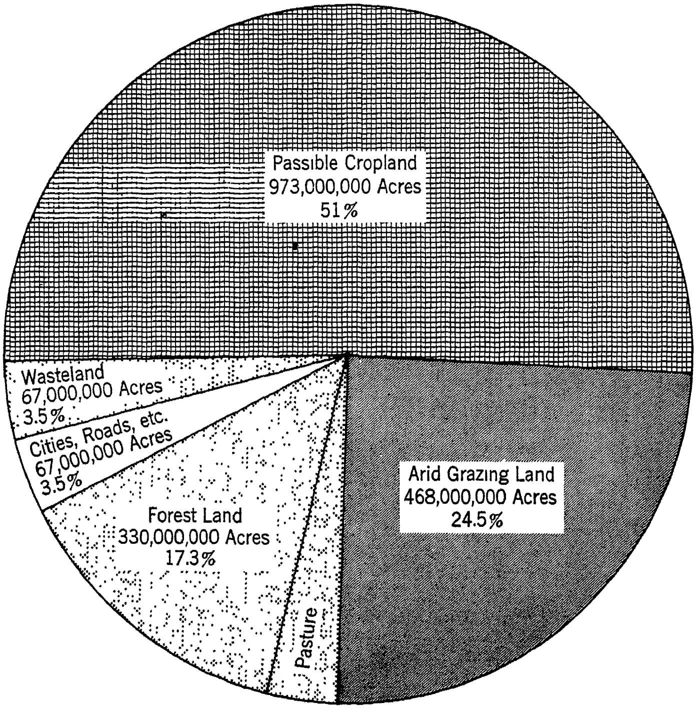

Fig. 18. Potential uses of land under extreme population pressure. Physically, 51 per cent of land area of the United States is suitable for crops, nearly 25 per cent for grazing only, and 17 per cent is best suited to forests and grazing. However, it is likely to be many generations—if ever—before it will be economical to produce crops on all the land physically suitable. Yet the estimate is an approximate measure of our resources.

Potential Agricultural Area and Population. How to provide food that is adequate both in quantity and quality to meet the needs of an increasing population is one of the serious problems confronting every nation that endures during any extended period. Many nations must turn to an outside source of food supply; a few have an abundance of potentially productive lands within their borders. The chief agricultural uses that any nation makes of its land are for crops, pasture, and forest. Nearly one-fifth of the land area of the United States produces harvested crops; about two-fifths produces pasture; and nearly one-third is occupied by forest and cut-over land, more than half of which is pastured. See Fig. 17. However, the value of the harvested crops produced on the one-fifth so used is immensely greater than the value produced on the seven-tenths devoted to pasture and forest. For many years the United States met its food requirements for consumption and export by bringing new land under cultivation. The peak of agricultural land supply in proportion to population was passed many years ago, and the future will show a continually increasing scarcity of such land. Nearly all the land suitable for crops, pasture, or forest has long since been appropriated; hence an increase in food supply must come either (1) from increased yield per acre, or (2) at the expense of pasture and forest area. It seems certain that both means may be utilized to advantage.

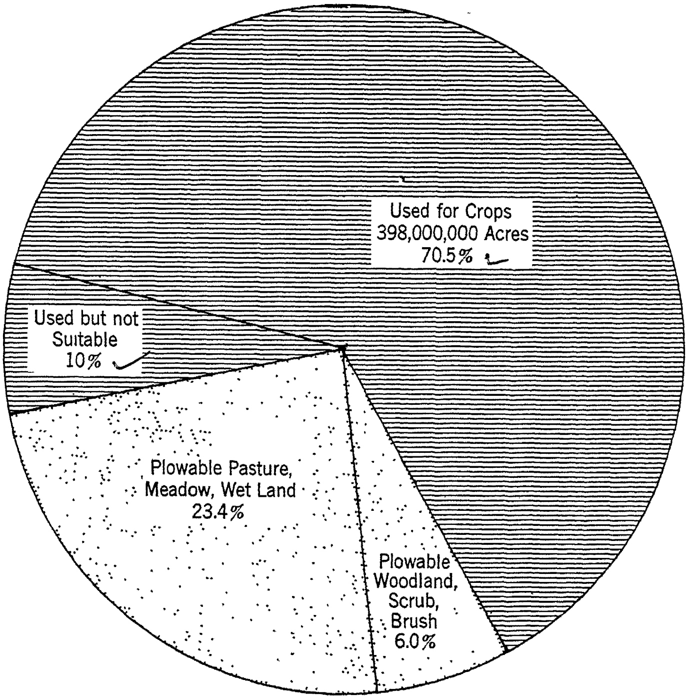

Fig. 19. Potential cropland in farms. If 64,000,000 acres of plowable land are reserved for pasture the potentially good cropland in farms is approximately 460,000,000 acres.

The United States has about 973 million acres physically capable of producing crops, about 398 million of which are now used. See Fig. 18.

It is, however, idle to assume that the maximum will ever be so used or, at least, until the need is extreme and cost of utilization is of little consideration. Such figures have value only as indicators of maximum potentiality. It is more realistic to think in terms of lands now in farms (Fig 19). Out of some 564 million acres, 398 million are used for crops even though some 40 million acres are very poor land and not economical to use. There are about 166 million acres of unused plowable land in farms. These consist of pasture, wet lands, meadow, woodland, scrub and brush lands. It appears probable that at least 64 million acres of this land should be reserved for pasture. This leaves a potential of good plowable cropland in farms of about 460 million acres. Further drainage and irrigation of land not in farms will add considerably to the potential productive capacity of the country. It has been estimated that a population of 170,000,000 can be cared for without seriously altering the standard of living, by adding to crop acreage and yield, by improved pasturage, mechanization, and technology. These changes have been in progress for many years. Beyond that number of people, both the standard of living and crop yield an acre must be materially altered. Such alterations are now in progress. If the acre-yield is increased until it equals that of western Europe, and a European standard of living is accepted in the United States, about 300,000,000 people can be provided for. It is likely that for many decades the reality will be between these two population estimates, as standards of living and acre-yield slowly change.

These estimates, however, assure us that the United States has the land resources capable of maintaining a considerably larger population than it now has, on a living level far above that of western Europe. The United States possesses agricultural advantages both geographic and nongeographic that are superior to those of any other nation. Among these are (1) great extent of highly fertile and varied soils on nearly level or gently rolling plains, (2) varied and highly favorable agricultural climate over the fertile plains, (3) a healthful and stimulating climate, (4) an excellent transportation system, (5) excellent home markets and accessibility to foreign markets, especially those across the narrow Atlantic in western Europe, (6) a highly developed system of agricultural education and government aid, both state and national, and (7) a strong, stable government.

MINERALS AND POWER

Next to the products of the soil, modern, complex, human life—called "civilization"—depends for its material success upon the application of mechanical power to machinery. The application of power to the machine has made it possible for man to rise far above primitive living. Such application has increased his productive capacity tremendously. It is probable that the energy output of the United States is more than 300 times its population. In any nation the critical elements are (1) agricultural lands, (2) minerals, (3) manpower. The use of agricultural land is the measure of the capacity to provide food and clothing; the use of minerals is th measure of the capacity for industry, transportation, and communication; and manpower is the measure of the capacity to utilize effectively the resources at hand. Any nation that has abundant agricultural land, abundant and varied minerals, and abundant and intelligent manpower is in a very strong position. Industrial development requires extensive use of minerals—coal, water, oil, gas, iron, copper, and others. The United States has nearly all the important minerals. Sources of power are also widespread, which together with man's utilization of coal, water, oil, and gas are well illustrated by the sources of energy for electric utilities (Fig. 20). Only a few minerals are of such vital significance that they need to be considered here.

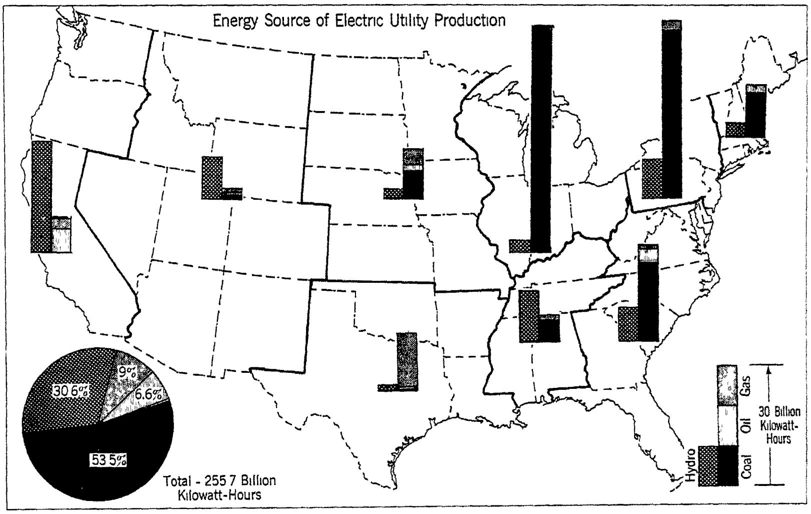
Energy Source of Electric Utility Production
30.6%
9%
6.6%
53.5%
Total - 255.7 Billion Kilowatt-Hours
Hydro
Coal
Oil
Gas
30 Billion Kilowatt-Hours

Fig. 20. Energy source of electric utility production. Note and explain the variation in the source of energy.

Iron. Of all mineral derivatives, iron may be considered the indispensable one, though its use is well-nigh inseparable from that of coal, which is needed for its production and as one source of power to drive the machinery made from it. It is the most important of all metals to man—probably more than all other metals combined. The iron-ore deposits of the United States are both widespread and of high quality compared with much of the iron ore that is used in western Europe. It is fortunate, indeed, that the best and most cheaply mined ore is tributary to the Great Lakes, over which it may be transported, at low cost, to those centers in the central and eastern states where the presence of good coal fosters manufacturing and the development of great consuming markets. Within the country's borders is located about a quarter of the known metallic iron of the world, and the United States has sufficient coking coal with which to smelt the iron. Though the higher-grade ores would be exhausted within a generation were it possible to maintain the present rate of production, the vast amount of lower-grade ore assures a supply ample to the country's needs for an indefinite time. On the basis of 40–50 per cent iron content the estimated reserves of nearly 5,400,000,000 tons should provide for more than half a century. At present the United States imports some ore from Venezuela, Brazil, Chile, Canada, Norway, Sweden, Cuba, and Northern Africa. As high-grade ores decline more of the ores from Labrador and Venezuela will probably be used. It now appears that the world's reserves are sufficient to meet all human needs and that the United States has within its bounds, or readily available to it, with proper conservation, all it will ever require. National advantage will depend chiefly upon cost of obtaining the iron, and the United States is in a favorable position compared with other countries.

The production of iron and steel is often spoken of as a barometer of industrial prosperity and an index of the stage of modern material development, because of the basal importance of iron and steel in the activities of "civilized" man. On this basis the United States should rank high. Estimates indicate that it mines and consumes about one-third of the world's output of iron ore; produces more than one-third of the world's pig iron and more than half the steel. It is as nearly independent and self-sufficing as any nation can be, and is likely to remain so.

Coal. Machine power makes possible the difference between modern and primitive man. It makes possible our cities, our railroads, our manufacturing industries and extensive commerce, our great churches and schools, and much of our recreation and pleasure. In fact, our whole modern social and industrial fabric depends upon it. Coal is still the major source of that power (Fig. 22) and hence is fundamental to our well-being, as it is impossible to imagine a social and economic system, such as we now possess, depending upon the unaided labor of man. However, oil, water, and natural gas are becoming increasingly important as sources of power, and coal is declining relatively.

To meet its requirements, the United States produces nearly two-fifths of the world's coal, an annual tonnage which is nearly twice that of any

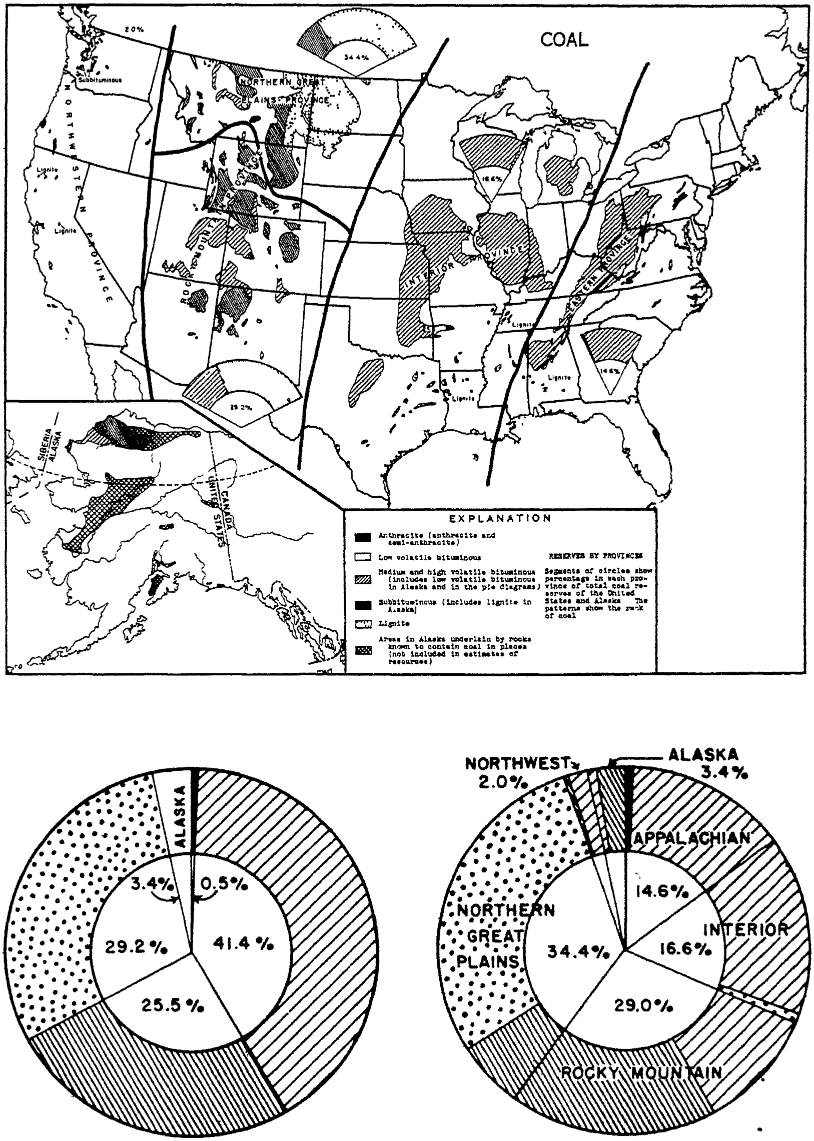
COAL
NORTHERN GREAT PLAINS PROVINCE
NORTHWESTERN PROVINCE
ROCKY MOUNTAIN PROVINCE
INTERIOR PROVINCE
EASTERN PROVINCE
Subbituminous
Lignite
2.0%
34.4%
16.6%
14.6%
29.0%
SIBERIA
ALASKA
CANADA
UNITED STATES
EXPLANATION
Anthracite (anthracite and semi-anthracite)
Low volatile bituminous
Medium and high volatile bituminous (includes low volatile bituminous in Alaska and in the pie diagrams)
Subbituminous (includes lignite in Alaska)
Lignite
Areas in Alaska underlain by rocks known to contain coal in places (not included in estimates of resources)
RESERVES BY PROVINCES
Segments of circles show percentage in each province of total coal reserves of the United States and Alaska The patterns show the rank of coal
ALASKA
3.4%
0.5%
29.2%
41.4%
25.5%
NORTHWEST
2.0%
ALASKA
3.4%
APPALACHIAN
14.6%
NORTHERN GREAT PLAINS
34.4%
INTERIOR
16.6%
29.0%
ROCKY MOUNTAIN

Fig. 21. Coal is well distributed throughout the country and is our chief source of energy, though declining in relative importance. Nearly all the high-grade coal is east of the Mississippi where more than nine-tenths of the total annual output is mined, and where it is of greatest usefulness. Reserves of the United States are enormous, constituting more than two-fifths of the known coal of the world. *Courtesy, U. S. Bureau of Mines.*

other country. Measured in heat or power units, the ratio in favor of the United States is very much greater, as a large proportion of European production is low grade. For the future the United States has more than two-fifths of the known coal of the world. Nearly all the coal of high grade is east of the Mississippi River, where it is of maximum usefulness and where more than nine-tenths of the annual output is now mined, chiefly in Pennsylvania, West Virginia, Illinois, and Kentucky. Even though the present rate of production of all grades is considerably increased, the supply is sufficient to last many centuries (Fig. 23). The high-grade coals, however, will be gone in much less time if production is confined almost exclusively to them as at present.

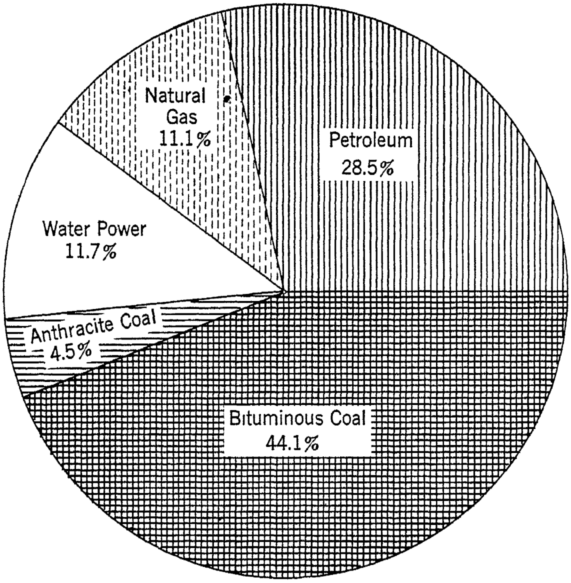

Fig. 22. Energy sources of the United States. Three-year average.

Water Power. Water is the most permanent and constant source of power (Fig. 24), as coal, oil, and gas are exhaustible. Present utilization in the United States is about 18.5 million kilowatts, and resource available, at mean flow, is calculated to be 84.8 million kilowatts. It is significant (1) that the larger amount probably would turn all the wheels of the country's present industries, and (2) that more than two-fifths is in the Pacific states, which are poorly endowed with good coal for their industries and railways. However, these resources undoubtedly would be of greater value if a larger proportion were located east of the Mississippi. It is clear that coal and water assets provide power adequate for all future needs.

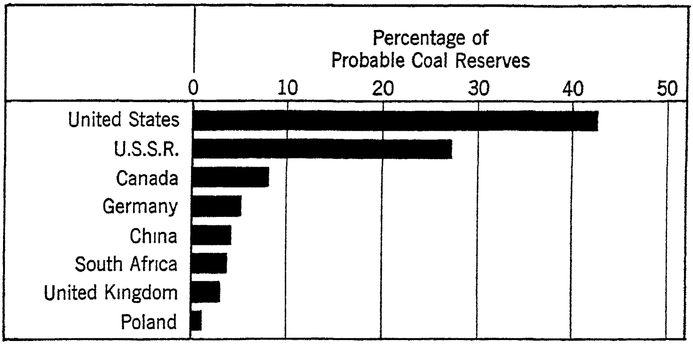

Fig. 23. Coal reserves of the world. The large coal reserves—mechanical energy—of the world are held by a few countries. The dominance of United States and U.S.S.R. is evident in the diagram. Eight countries have more than 95 per cent of the world's coal.

Petroleum. Petroleum has become a commercial necessity. It serves chiefly as a source of power, light, and lubricants, though scores of other refined products are derived from it. It is even conceivable that future national leadership in the air and on the sea may be determined by the

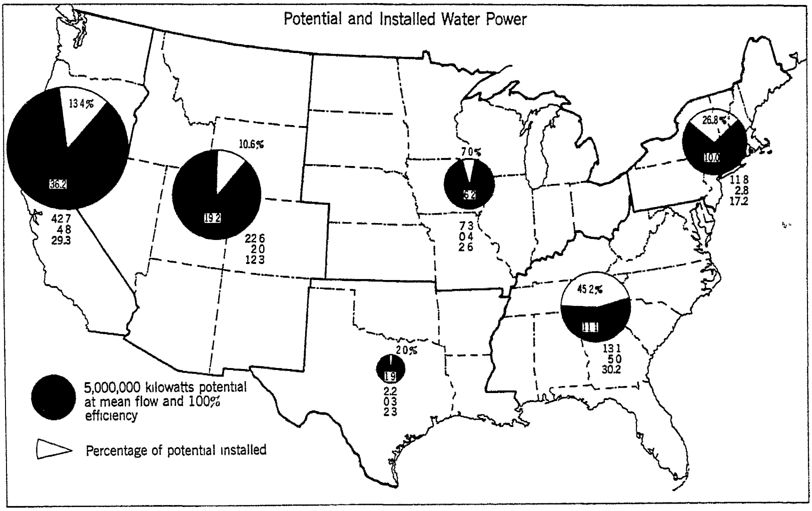
Potential and Installed Water Power
13.4%
36.2
42.7
4.8
29.3
10.6%
19.2
22.6
2.0
12.3
7.0%
5.2
7.3
0.4
2.6
26.8%
10.0
11.8
2.8
17.2
45.2%
11.1
13.1
5.0
30.2
2.0%
1.9
2.2
0.3
2.3
5,000,000 kilowatts potential at mean flow and 100% efficiency
Percentage of potential installed

Fig. 24. Distribution of water power in the United States. Two-thirds of the potential water power of the United States is in the Pacific and Mountain sections, and more than half of the developed power is in the eastern sections. The potential power available at mean flow is 84.6 million kilowatts. *Note:* Read figures beside circles as follows: The Southeast has 13.1 per cent of potential water power, based on mean flow and 100 per cent efficiency, and 5,000,000 kilowatts installed January 1, 1949, which is 30.2 per cent of the total installed in the United States

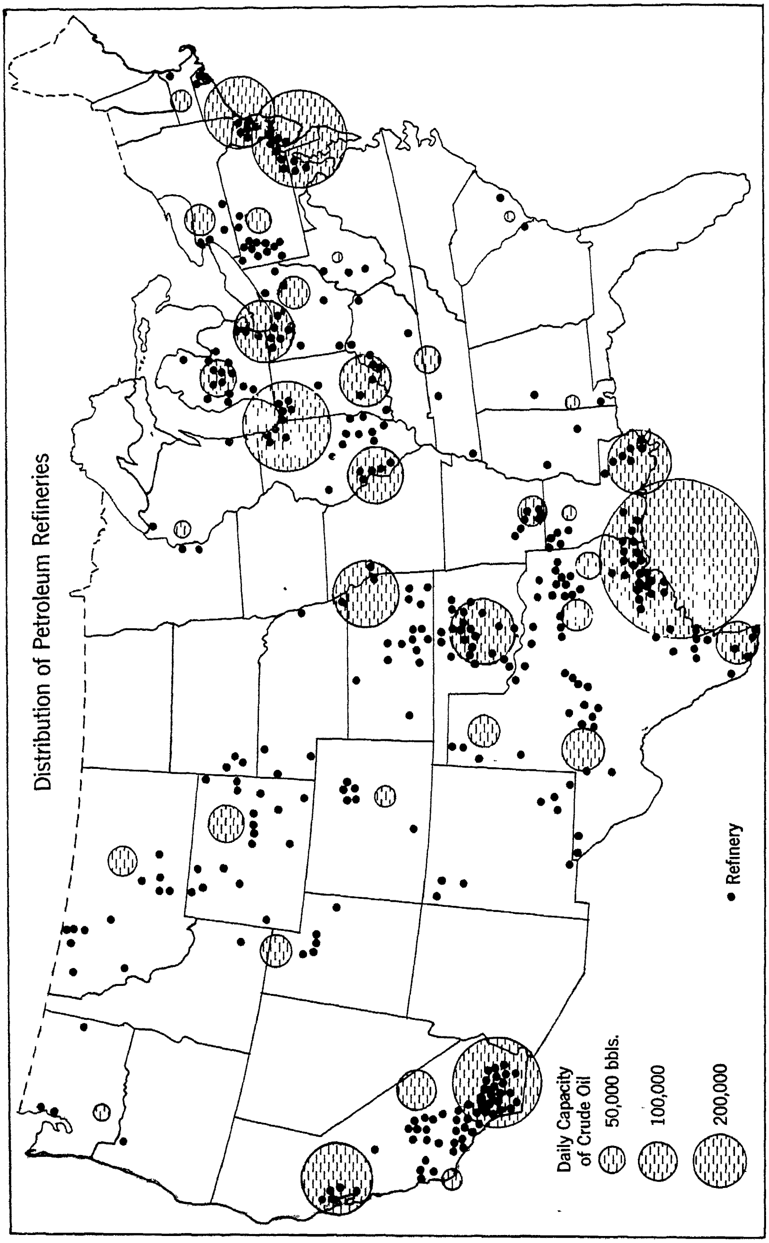
Distribution of Petroleum Refineries
Daily Capacity of Crude Oil
50,000 bbls.
100,000
200,000
• Refinery

Fig. 25. Distribution of petroleum refineries.

possession of fuel oil, kerosene, gasoline, and lubricating oil, since their efficiency for navigation purposes is greatly in excess of that of coal or its products.

Since the discovery of petroleum in western Pennsylvania in 1859, United States production has grown to enormous size. For several decades thereafter Pennsylvania led, but new fields were located and opened, and production spread to Ohio, West Virginia, Kentucky, Indiana, and Illinois; to the midcontinent field of Texas, Oklahoma, and Kansas; on westward to the California field, and to the Rocky Mountain Area. At various times many of these states have led in production, but now Texas is far in the lead. Peak production has attained nearly 2.25 billion barrels in a single year, although the average annual production rate is smaller.

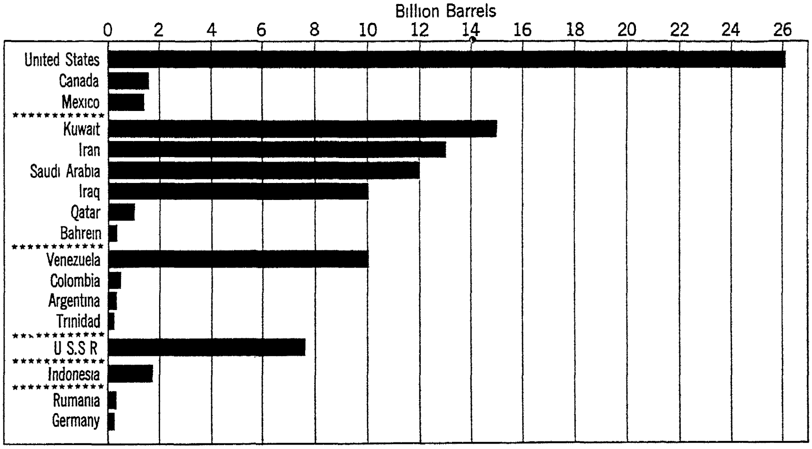

Fig. 26. Major petroleum regions of the world. Estimated proven reserves, as of January, 1951, were approximately 102 billion barrels, with half in the Middle East. How does this distribution affect international political and economic relations?

Outside the principal producing regions most of the refineries are located in the major manufacturing belt, from Illinois to New Jersey (Fig. 25). Well over a hundred thousand miles of pipe line convey the products of the oil and natural gas industry to refineries and consuming markets.

The United States has produced about two-thirds of the world's output, the maintenance of which ratio seems improbable. Even though other regions of the world have large known resources of liquid petroleum, those of the United States still exceed the reserves of any other country (Fig. 26). However, estimates indicate that some of the major fields in the United States are near exhaustion of proven reserves (Fig. 27). Texas has by far the largest reserve. Based on proven reserves and

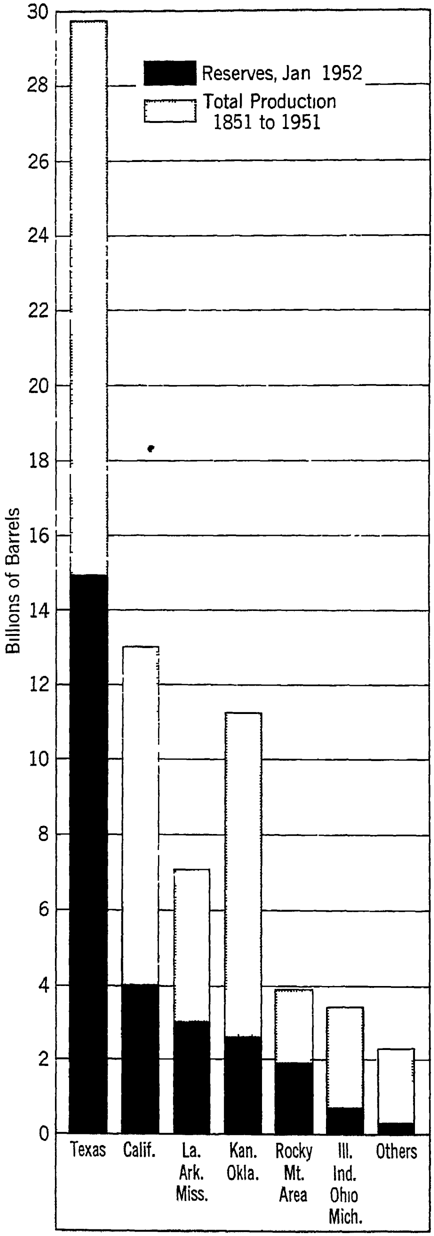

Fig. 27. Estimated crude petroleum reserves and cumulative production.

present methods of production resources will be practically exhausted within a half century, as the country is producing, exporting, and consuming at a suicidal rate. Every effort is being made to locate and develop new fields such as the Williston Basin, the Gulf of Mexico, and other continental shelf areas.

As exhaustion of liquid hydrocarbons approaches and prices become higher, the United States must turn to its large reserves of oil shales and increase greatly the recovery from wells, which is now scarcely half of the oil present. However, it is clear that a substantial advantage will lie with the nation possessing the cheapest liquid oil.

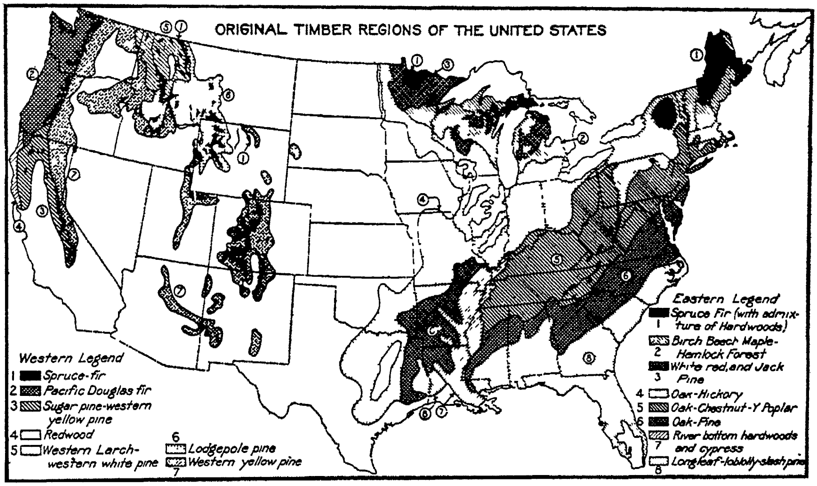
ORIGINAL TIMBER REGIONS OF THE UNITED STATES
Western Legend
1 ■ Spruce-fir
2 ▩ Pacific Douglas fir
3 ▨ Sugar pine-western yellow pine
4 □ Redwood
5 □ Western Larch-western white pine
6 ▤ Lodgepole pine
7 ▩ Western yellow pine
Eastern Legend
1 ■ Spruce Fir (with admixture of Hardwoods)
2 ▨ Birch Beech Maple-Hemlock Forest
3 ■ White red, and Jack Pine
4 □ Oak-Hickory
5 ▨ Oak-Chestnut-Y Poplar
6 ■ Oak-Pine
7 ▨ River bottom hardwoods and cypress
8 □ Longleaf-loblolly-slash pin

Fig. 28. Original forest lands. Much of the United States originally carried forests of highly useful timber. *Courtesy, U. S. Forest Service.*

HARVESTING OUR FORESTS

The Passing of Our Virgin Forests. To the early explorer and settler America appeared like a vast, unbroken forest. To him a future shortage of timber must have seemed impossible. Nearly half the area now within the United States was forested at that time (Fig. 28). To the pioneer the trees were a serious handicap and had to be removed for agriculture and settlement. Fully 200,000,000 acres were cleared for this purpose, and three-fourths of the timber removed was wasted, as there was no market. Later the demand for lumber led to rapid exploitation of the virgin forests. The fine northern forests extending from New England to Minnesota—the land of the stately white and Norway pines—were among the first to be attacked. The excellence of their timber and their location on the Great Lakes waterways and near the centers of large population favored rapid removal.

The central hardwood forest occupied large areas of agricultural land, and little now remains except on rough mountain and hilly tracts, or in farmers' woodlots. The southern forest is now falling before the advance of the lumberman. It is here that the United States secures most of the yellow pine, four-tenths of the softwood, and three-fifths of the hardwood saw timber produced annually. In addition the South now exceeds the North in pulpwood production, nearly all of which is from pine. Scores of pulp and paper mills have been erected or enlarged since about 1930 (Fig. 33). The Rocky Mountain forests are located in scattered areas, difficult of access and remote from markets, and hence have been exploited but little. However, they do not constitute a large timber resource. The Pacific Coast forests, with their Douglas fir, redwoods, spruce, cedar, yellow pine, and giant sequoias, are among the finest in the world. The warm summers, mild winters, heavy rainfall, and deep soil of this region make ideal conditions for tree growth. At present it supplies 45 per cent of the annual production of softwood saw timber. Here still stands half the remaining saw timber of the United States, of which more than a third is Douglas fir. Exploitation of these splendid forests is

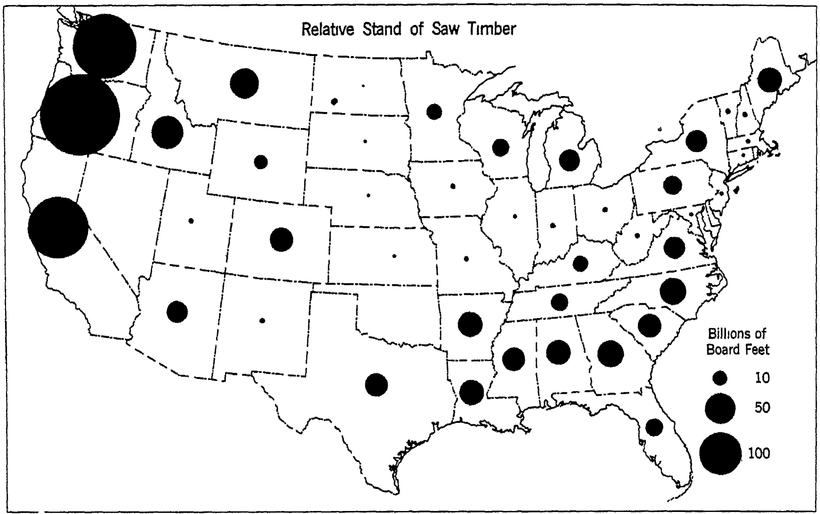

Fig. 29. Relative stands of saw timber. Three-fourths of the present forest land is in the East and one-fourth in the West, but the West carries most of the remaining saw timber. About half the standing saw timber is in the Pacific Coast States.

now progressing rapidly. Today about two-thirds of the original forested area has been cut-, culled-, or burned-over, and fully three-fifths of the timber is gone.

Production and Depletion. The forests have been removed like coal from a mine, with little thought of a new crop. The pressing problem is to increase growth to meet the demand for saw timber, which constitutes 80 per cent of the forest drain. The United States is the largest wood consumer in the world, and the demand for wood is increasing in spite of all "substitutes." This enormous demand has produced a destructive drain upon forest resources (Fig. 31). Today only about two-fifths of the original supply of timber remains; only about one-sixth of the original forested area carries virgin timber; only about one-eighth, second-growth saw timber; about one-sixth, cordwood; and one-tenth is unproductive. Nearly two-thirds of the remaining stand of saw timber is west of the Great Plains, with half in the Pacific Coast states, and about one-fifth in the Gulf and south Atlantic section (Fig. 29). These sections are now supplying home needs and a small surplus for export. Since nearly half is consumed in the northeastern quarter of the country, a long haul and high cost are involved. In the North, fir, spruce, hemlock and pine supply three-fourths of the pulpwood, where cut-over land and small trees are utilized, where water power is available, and where the markets are

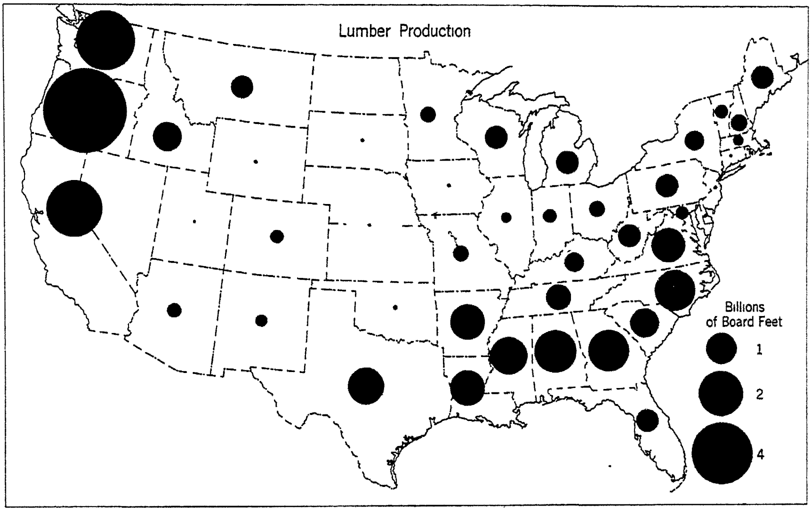

Fig. 30. Lumber production. The Pacific Coast states produce 45 per cent of the softwood timber and the South about 40 per cent of the softwood and 60 per cent of the hardwood timber.

nearby. The United States also produces a large share of the world's naval stores, chiefly from southern forests.

Nearly seven-tenths of the timber of all kinds consumed in the United States is softwood—pine, fir, spruce, hemlock—and the softwood saw timber is being removed about one and three-fourths times as fast as it grows (Fig. 31). The annual rate of forest depletion from all causes, measured in cubic feet, nearly balances the growth. However, this ratio of growth to drain is deceptive since the growth figures include small poles and saplings, and the drain of saw timber is more than half again as great as saw-timber growth, which is needed for human use. Though many economies can and should be practiced, though numerous substitutes for wood may be found, many new uses for wood are being developed and the demand continues. In the last analysis, there is one real solution to the forest problem: trees must be grown, and the mining of the forests must cease. Approximately two-thirds of the original forest land is still available, and estimates indicate that at least 61 billion board feet of saw timber annually will be needed within the next 5 to 8 years. If intensive forestry comparable to that of Scandinavia, Germany, and France is

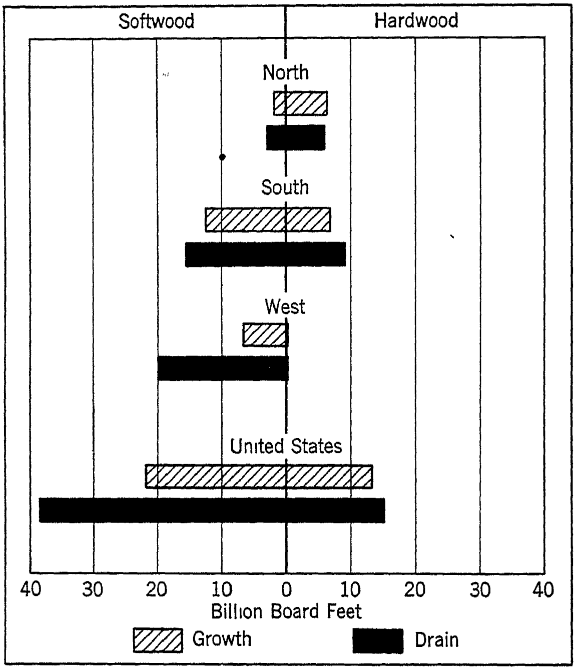

Fig. 31. Annual growth and drain of saw timber in the United States. *Courtesy, U. S. Forest Service.*

practiced, the 624 million acres of forest land can produce all that the nation is ever likely to need. In addition the forests of Alaska may be utilized. Thus far the United States has followed a policy of immediate profit rather than one of provision for future need. The best welfare of the country demands a complete reversal of this policy.

Public and Private Forests. Probably because of the popular belief that the forests were inexhaustible, the Federal Goverment was slow in becoming an active leader in conservation. Federal funds were appropriated for forest investigations as early as 1876, but nothing was accomplished. The first reserves were created in 1891, but no National Forest was so designated until 1905, when a forest policy was definitely established for the first time. Additional areas have since been set aside or purchased until the total area of the National Forests has grown to 123 million acres (net). To this may be added about 38,000,000 acres set aside by states and local units such as counties, schools, municipalities, and 54 million acres administered by various Federal agencies other than the Forest Service. Only part of this area is productive forest land. Private commercial forests contain about 345 million acres, or nearly three-fourths of the total for the United States. More than three-fourths of this area is held by more than 4 million owners, such holdings averaging about 62 acres (Fig 32). This makes establishment of a sound forest policy and management extremely difficult. A vast program of education appears to be

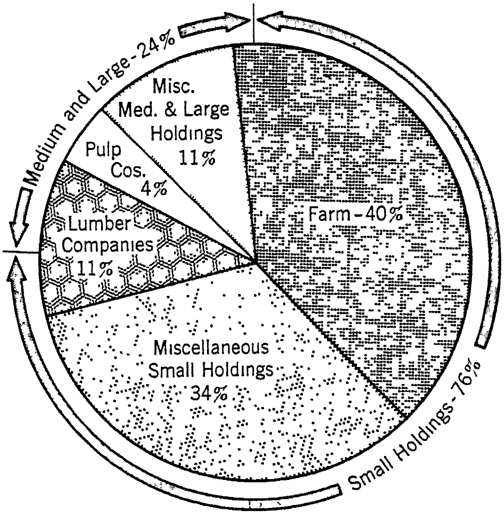

Fig. 32. Distribution of private commercial forest land by class of ownership. *Courtesy, U. S. Forest Service.*

essential if these lands are to be utilized to the fullest. Many large holders, particularly those engaged in forest industries, endeavor to practice good forestry methods, but there is no uniformity. Extensive areas are held by absentee owners. Vast areas must be planted and protected from fire and disease, and growing tree crops on private lands must be encouraged if future needs are to be met.

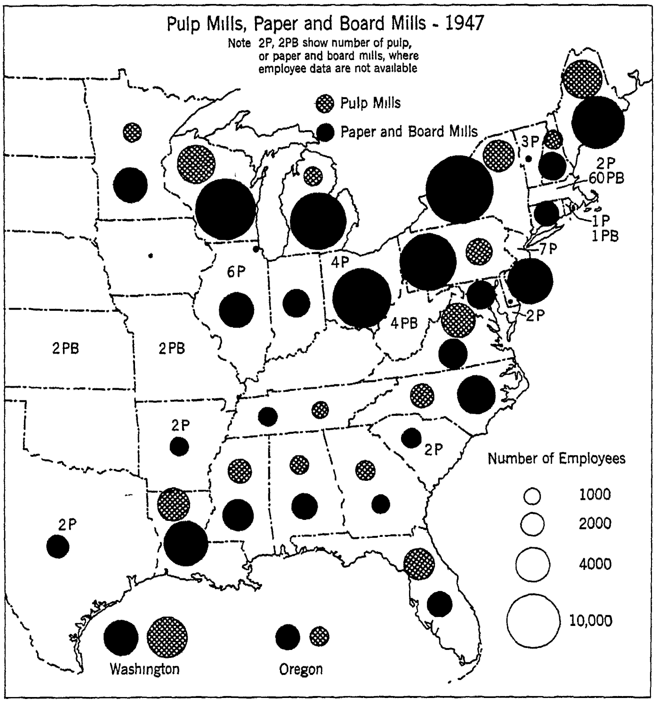
Pulp Mills, Paper and Board Mills - 1947
Note 2P, 2PB show number of pulp, or paper and board mills, where employee data are not available
Pulp Mills
Paper and Board Mills
3P
2P
60PB
1P
1PB
7P
2P
4P
4PB
6P
2PB
2PB
2P
2P
2P
Number of Employees
1000
2000
4000
10,000
Washington
Oregon

Fig. 33. Pulp mills, paper and board mills. Most of the mills are located in the North Atlantic and Great Lakes States, however, the South now exceeds the North in pulpwood production. Rapid expansion in the South is now underway.

MANUFACTURES

Growth. Agriculture is fundamental; mining and manufacturing are secondary. This was strikingly true in the development of the United States until comparatively recent times. For many years, cheap land was abundant, population was small, and anyone could have a farm by winning it from the forest or prairie. The numerous opportunities for the individual to gain ample reward independently were unfavorable to the factory system of manufacturing, which requires regularity of routine labor for others. During the colonial period manufacturing was insignificant. Only cotton and iron manufactures had made much progress by 1830. Though the country began to feel its manufacturing power before the beginning of the Civil War, only since about 1870 has its people really discovered and begun to utilize their great resources. Those varied and abundant resources, in a land of large size, have led to manufacturing on an immense scale by huge industrial organizations unequaled in any other country. Here again, the country expresses itself in the superlative. Thus far it has gone on by exploiting natural resources while the population has been rapidly increasing—a process that cannot continue indefinitely. Clearly there must be an elimination of waste, an increase in production, technology, and efficiency, or a decrease in rate of population growth, or opportunities will vanish and the people will be obliged to seek homes in other lands, like many of those of European countries.

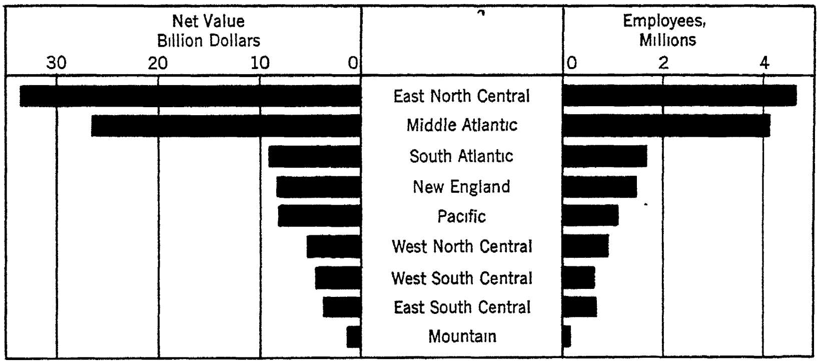

Fig. 34. Manufactures by sections (1951). The East North Central (Great Lakes) and Middle Atlantic sections produce about three-fifths of the net value of the manufactures, and have nearly the same proportion of manufacturing employees.

These requirements now seem assured. Farms, forests, mines, and factories are completely dependent on one another for their fullest development. Their abundant products provide for transportation and commerce and for a prosperous people. Since the United States possesses all the fundamentals of national prosperity—power, agricultural land, raw materials, labor, capital—it appears certain that the conversion of raw materials into finished products and their sale in domestic and foreign markets will enable the country to maintain its high standard of living, provide abundantly for its people, and continue manufacturing progress far beyond that of any other nation. At present the only possible serious competitor appears to be U.S.S.R.

Present Position. United States is the leading manufacturing nation of the world. The total net value of its products reaches the huge sum of

$102,000,000,000 (1951) (which is a fair value measure of the significance of the manufacturing process [2]); and 15,600,000 people are employed in its mills and factories. Probably not less than five times that number of people are directly or indirectly dependent upon them. Among the major industrial groups, machinery and food products are responsible for more than a quarter of the net value and engage a like proportion of the country's manufacturing employees. These are followed in order by transportation, primary metals, chemicals, metal and textile mill products. These seven groups account for three-fifths of the employees and two-thirds of the net value of the manufactures of the United States. They occupy a commanding position in American industry. In addition, many other groups (Fig. 35) give employment to several million people and produce many billions of dollars worth of goods. This indicates great diversification and industrial strength.

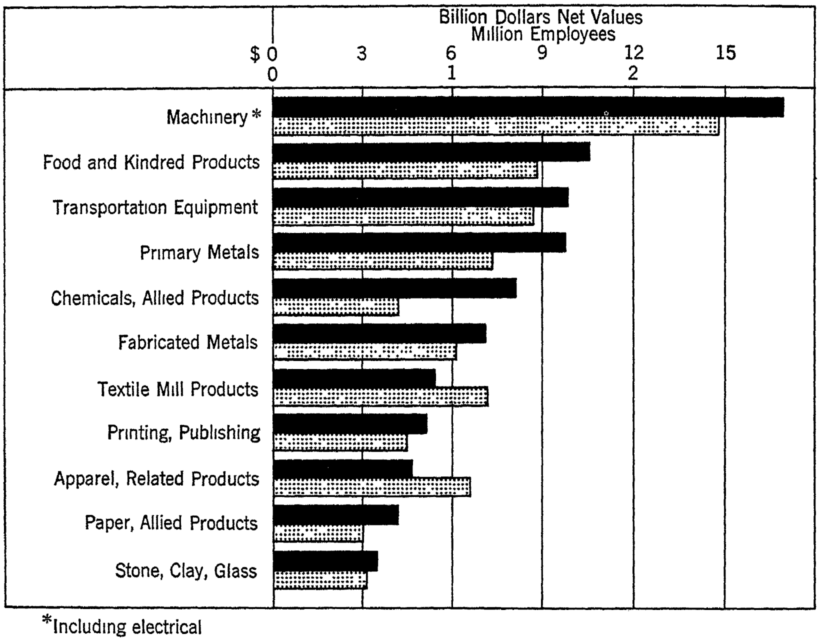

Fig. 35. Manufactures of the United States by major industrial groups (1951). By the measures used, machinery and food products lead all other groups of manufactures. The first seven groups account for three-fifths of all manufacturing employees and two-thirds of net value of manufactures of the United States. The diagram shows large diversification and many other smaller groups differing from each other by small margins. Does this diagram display weakness or strength?

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[2] The terms "net value" and "product value" are suggested and here used in place of the cumbersome forms—"value added by manufacture," and "value of manufactured product." However, both forms will be found in this book. Which is preferable?

DISTRIBUTION OF MANUFACTURING

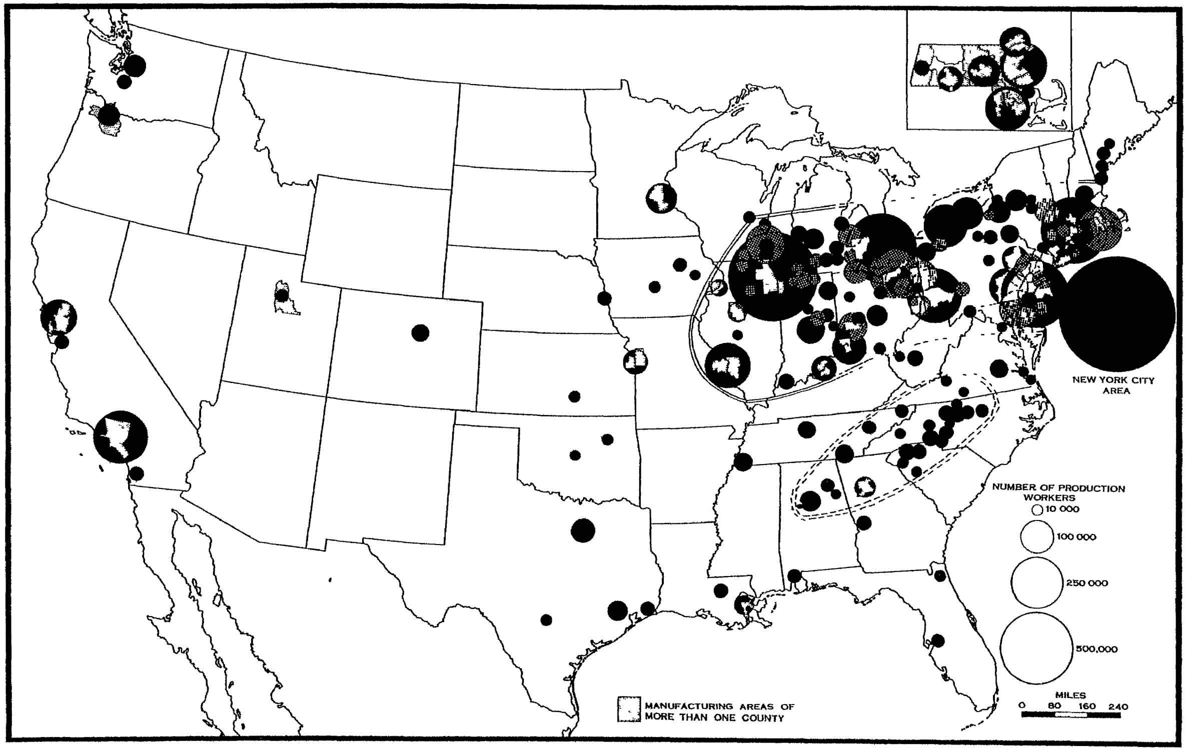
NEW YORK CITY AREA
NUMBER OF PRODUCTION WORKERS
10 000
100 000
250 000
500,000
MILES
0 80 160 240
MANUFACTURING AREAS OF MORE THAN ONE COUNTY

Fig. 36. The major manufacturing belt contains only about one-tenth of the area of the country, but it has about half the population, and more than seven-tenths of the employees and net value of products. With one exception, it contains the first ten leading industrial cities. The secondary belt, extending from Virginia to northern Alabama, has more than one-third of all manufacturing employees outside the major belt.

Distribution of Manfacturing. It is interesting to note that the Great Lakes states now exceed the Middle Atlantic, measured by either number of employees or net value of products (Fig. 34). By each measure the Great Lakes states are credited with a little more than 30 per cent of the total for the country. However, the major manufacturing belt of the United States occupies a comparatively small strip of country extending from southern Maine and central Maryland westward to Iowa and Missouri. Portland, Baltimore, St. Louis, and Milwaukee may be taken as the end cities of this strip (Fig.,36). This small strip contains about one-tenth of the area of the United States; has more than seven-tenths of the employees and net value of products; has half the population; and, with one exception, contains the first 10 leading industrial cities. Out of 53 standard metropolitan areas, four-fifths are in the major manufacturing belt and only 2 such areas, producing a net value of 1 billion or more, are outside. Here are essentially all the industrial organizations operating on a huge scale. New York, Pennsylvania, Illinois, and Ohio are leading states; and New York, Chicago, Detroit, and Philadelphia the leading cities. In many respects the region resembles the Ruhr-Rhine-Belgium section of western Europe where industry has reached a high stage of concentration.

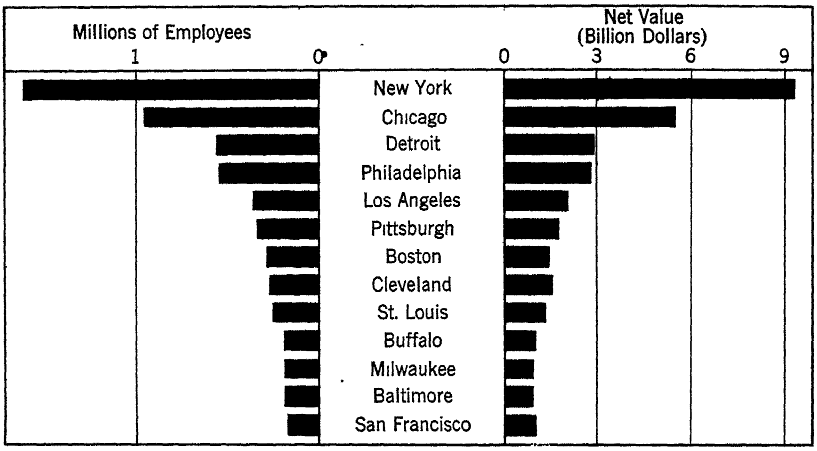

Fig. 37. Standard metropolitan industrial areas. New York, Chicago, Detroit, and Philadelphia are the four outstanding manufacturing centers of the United States. All are ocean, lake, or river ports.

A secondary manufacturing belt has been taking shape. This belt extends from Virginia to northern Alabama. More than a third of all manufacturing employees of the United States, outside the major belt, are in this new secondary belt. The reasons for the great concentration in the major manufacturing belt are largely geographic, as this region is especially favored in its natural-resource equipment, possessing (1) abundant, accessible power in the form of coal, oil, gas, and water; (2) great variety and abundance of agricultural raw materials produced within or readily accessible to it—cotton, livestock, cereals; (3) great variety, abundance, and accessibility of important minerals—iron, coal, oil, copper; (4) excellent home markets which are both a cause and an effect of the industrial development, and accessibility to foreign markets; (5) excellent transportation facilities by railways, inland waters, and by sea; (6) abundant skilled labor and ample capital; and (7) the momentum of an early start.

Among other factors which favor industrial development in the United States, which are shared by this region but in which it has no superior advantage over some other sections, should be mentioned: (1) a healthful, invigorating climate; (2) self-sufficiency in food supply; (3) a strong government assuring stability and giving assistance; (4) a standard of education for the masses far above that of other countries; (5) a consuming population having a high standard of living; and (6) a capable, energetic people derived from the progressive stocks of industrial Europe. Taken as a whole, these constitute the industrial assets of the United States.

TRANSPORTATION AND COMMUNICATION

The facilities for transportation and communication and the use made of them are indices of the material development of a country and the general level of prosperity of its people, as they are both the cause and the effect of industrial progress. Chief among such facilities are railroads, highways, waterways, motor cars, telegraph, telephone, and postal service. Though the United States has only about 6 per cent of the world's population, it has approximately

1. 30 per cent of the world's railroad mileage.
2. 57 per cent of the world's telephone instruments.
3. 72 per cent of the world's automobile passenger cars, trucks, and buses.
4. 38 per cent of the world's highway mileage.
5. 31 per cent of the world's broadcasting stations.
6. 51 per cent of the world's radio sets.

Although definite world data are not available, it is certain that the United States has a very large proportion of the world's telegraph and civil aviation service. In the distribution and use of these facilities the United States excels any of the principal nations having a large population, but is exceeded in a few cases by countries having a small population.

Railroads. The eastern half of the country is provided with a close network of railroads so that no productive area is far from transportation facilities; the western half, which is drier and less productive, is crossed by several trunk lines. Thousands of miles of navigable rivers are available, but the total freight carried by rivers is small compared (1) with that moved by the railroads, or (2) with the possibilities of rivers as carriers when the population is as static and as dense as that of western Europe. There are many reasons why railroads meet the demands of modern industry more effectively than rivers and canals: (1) Railroads may reach the resource to be developed and the industrial center to be served, and a network of facilities may be provided to any section by building branch lines. (2) Through shipments are obtainable on railroads to every important part of the country, and even to the door of the industrial establishment, thus reducing truckage and handling costs to the minimum. (3) Railway transportation is much faster. (4) Railways operate throughout the year, whereas many rivers are closed to traffic by ice and some by low water during part of the year. (5) Railroads can readily meet the shipping needs by varying the size and frequency of trains, thus controlling the cost.

Waterways. The total freight-tonnage on all United States rivers exceeds 200,000,000, more than three-fifths of which is on the Mississippi, Ohio, and Monongahela. This means that, taken as a whole, rivers are important carriers. Though the tonnage carried by all rivers is highly significant in the transportation system no one river carries a strikingly large amount. In contrast with rivers, the Great Lakes provide the greatest inland waterway of the world whether measured by extent or volume of traffic. The total tonnage (United States) carried on them annually is more than half as large as the combined tonnage of the Atlantic, Gulf, and Pacific Coasts, whereas the tonnage passing through the Sault Canal is more than four and one-half times that of the Panama Canal. Because of the economies possible in handling such a large volume of bulk cargo—iron ore, coal, grain, pulpwood—it is probable that the freight rates on the Lakes are lower than for any unsubsidized water service in the world. It is proposed to open the Great Lakes to the sea by deepening the St. Lawrence route to permit the passage of ships of 27-feet draft from Lakes to tidewater. The arguments of the proponents of this plan remind one of the extravagant claims advanced at various times in the past when the building of sundry other canals was being considered. The arguments of the opponents are equally vigorous, and the two groups make clear the influence of geographic location and resources in the development of sectionalism—the Middle West demanding a cheap water outlet, and the

North Atlantic region being desirous of retaining the Middle West as a part of its hinterland. The evidence available at present appears to favor the construction of the proposed waterway.[3] With the exhaustion of high-grade iron ore in the Lake Superior region, completion of the St. Lawrence Seaway might prevent profound changes in the location of the iron and steel industry.

Highways and Airways. Motor vehicles for the land and ships for the air are revolutionizing our concepts of transportation. Though their use has grown with great rapidity many people are still thinking in terms of canals and "improved" rivers. This is especially true when funds for such projects are to be taken from the public treasury. Highways now reach all parts of the country. The more than 3 million miles of highways is more than a third of the world's total and averages about 1 mile for each square mile of area. Half our highways are already surfaced for all-weather use. Over these highways travel more than 40 million passenger cars, buses, and trucks, providing a service unequaled in any other part of the world.

Travel, and transport of mail, express, and freight by airplane are well established. This service is now a routine part of the United States transportation system. A network of more than 68,600 miles of trunkline airways, largely equipped with all modern devices to assure safety and service, serves the country today. Over these routes scheduled operators fly nearly 340,000,000 revenue miles a year and carry more than 13,000,000 passengers. In addition to passengers, air service now carries a high tonnage of express, freight, and mail. This far exceeds the airplane service of any other country, yet the development of such service is probably in its infancy.

FOREIGN TRADE

Nature of Trade and Conditions Giving Rise to It. Commerce, or trade, is the movement of products from regions of surplus to those of deficiency. Such movement may be over comparatively short distances, as from farm to adjacent city, or may be over great distances, as between countries located on opposite sides of the earth. Trade depends primarily upon the wants of people, the ability of those people to pay for the thing wanted, and the ability of other people to produce and transport it or have it transported. The conditions that result in a surplus in one region and a deficiency in another may be geographic, ethnic, economic, or political, differences in geographic environment being the more important factors. Among the differences giving rise to commerce are the following: (1) differences in climate, e.g., tropics *vs.* midaltitudes; (2) differences in soil, mineral, forest, and other natural resources, e.g., coal, petroleum, lumber; (3) differences in availability of markets, e.g., fresh vegetables *vs.* cotton, silk, or wheat; (4) differences in relief, e.g., between highlands and lowlands; (5) differences in the stage of cultural development—"civilization"—and in specialization, e.g., a manufacturing people *vs.* an agricul-

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[3] "An Economic Appraisal of the St. Lawrence Seaway Project," *Industry Report on Domestic Transportation*, Department of Commerce, Bureau of Foreign and Domestic Commerce, 1947.

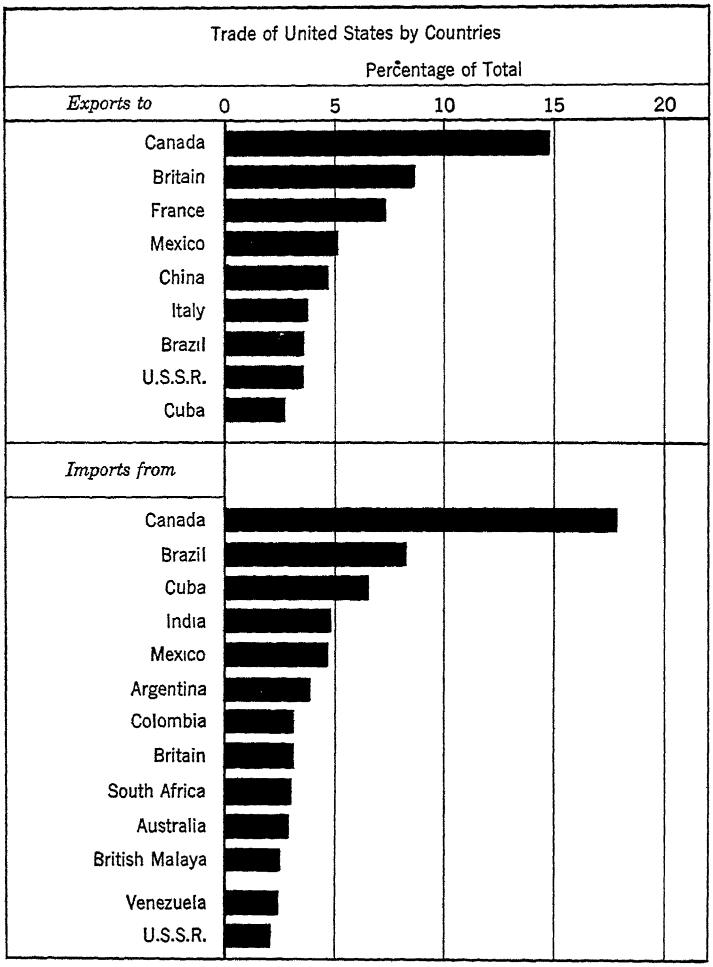
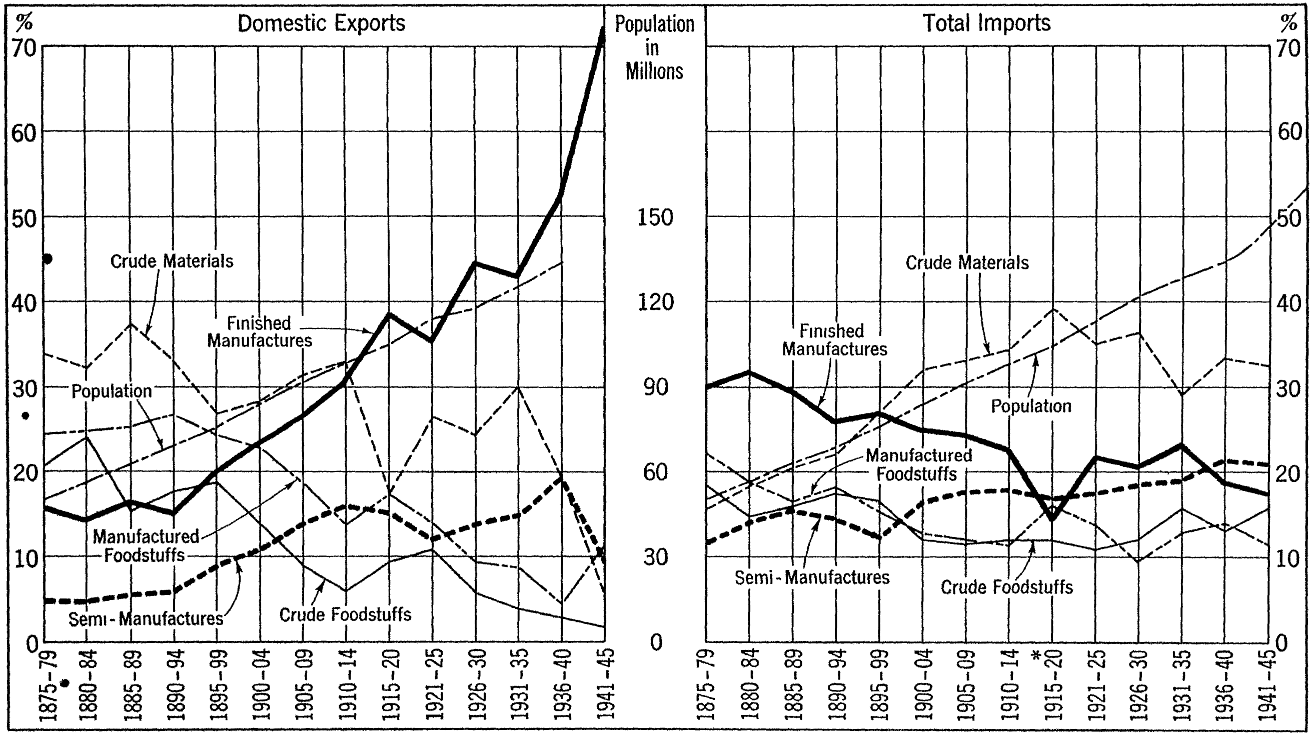


Fig. 38. Trade of the United States with principal foreign countries. Canada is the best customer and sells far more to the United States than any other country, measured by percentage of value.



*Fiscal years before and calendar years after 1915

Fig. 39. Changing character of the foreign trade of the United States as shown by percentage of value. The population increase has been accompanied by a decrease in exports of foodstuffs and crude materials and an increase in manufactured products. At the same time importation of finished manufactures has decreased, semi-manufactures have increased slightly and crude materials have increased greatly

tural one, and the distinctive artistic wares of the French or the lacquer wares of the Japanese; (6) differences in political policies which result in tariffs, rebates, subsidies, etc. The differences in climate, soil, topography, and other natural resources within the United States give rise to an enormous domestic trade, and the same conditions produce a large surplus that enters foreign trade. It is this surplus with which we are especially concerned here.

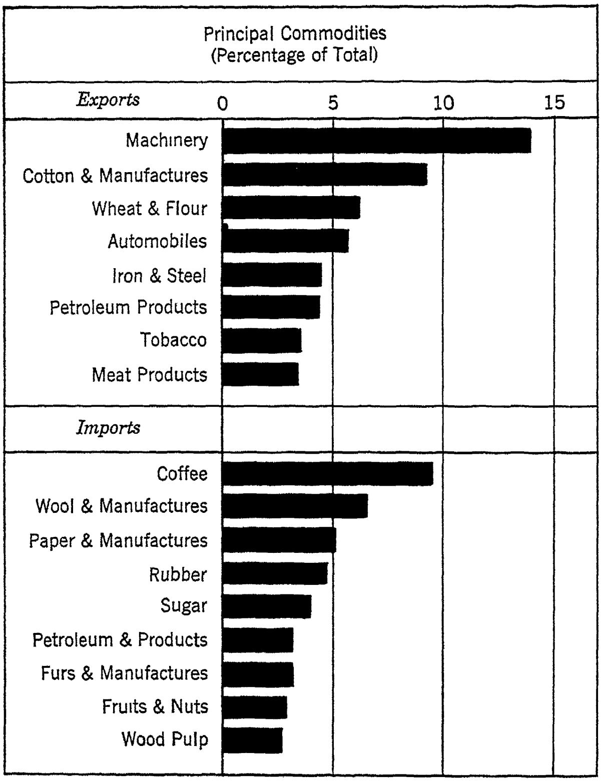


Fig. 40. Trade of United States by principal commodities.

Development of United States Foreign Trade. Foreign commerce was a vital factor in the early colonial period. The hinterland of the colonist was largely untraversed and undeveloped; hence he looked outward across the ocean to the markets of the more developed "mother countries" whence he came. For many years he sent his produce, chiefly raw materials, to Europe and other parts of the world, and imported manufactured wares. During the colonial period and for many years following the Revolutionary War, American ships carried most of the trade, averaging from four-fifths to nine-tenths up to 1830 and about two-thirds at the beginning of the Civil War. The loss of vessels during the Civil War; the rapid expansion westward and the development of agricultural lands and vast mineral and forest resources after the war, and the consequent opportunity for investment at home; the change from sailing to steel steamships; and the repeal by Congress of laws that favored American shipping led to a rapid decline to less than one-tenth in 1890. Not until 1900 did the total value of foreign trade exceed $2,000,000,000. The more complete development of natural resources, the expansion of manufacturing to surplus production, a corresponding demand for foreign raw materials, and the stimulus of two world wars have renewed interest in foreign trade and a United States merchant marine (Fig. 38). Today the export trade is more than twice that of any other country and imports are second in value to those of Great Britain. This ratio is due in part to the devastating effects of World War II, especially in Europe; greatly increased price of goods; and loans and gifts to war-stricken countries.

The Character of the Trade. The changing character of United States trade since about 1900 is shown in Fig. 39, a change which reflects the extent of the internal development of the United States. The relative decline in exports of raw materials and foodstuffs has been accompanied by an increase in exports of manufactures and in growth in population. At the same time, crude materials and semimanufactures have come to constitute a major proportion of the imports, and finished manufactures a minor percentage. The United States has entered upon an era of greater economic maturity—manufacturing its own raw materials, as well as those imported, and seeking a foreign market for the finished products. Machinery is the leading export, and cotton and cotton manufactures rank second. These are followed closely by wheat and flour, and automobiles. Principal imports are coffee, wool and woolen manufactures, paper and manufactures, rubber, and sugar. Canada is the chief market and supplies more imports than any other country.

Commercial Gateways. Foreign trade now follows well-established routes through comparatively few ports of outstanding importance (Fig. 41). These gateways have attained their prominent positions because of their superior geographic and economic conditions, such as (1) a large, highly productive and easily accessible hinterland having a large population, and (2) good harbors possessing extensive and well-equipped dockage facilities. Since the highly productive area of the country lies east of the Mississippi directly tributary to eastern ports, and since most of the trade is transatlantic, the Atlantic Coast gateways handle nearly three-fifths of the total commerce, and combined with those of the Gulf Coast nearly three-fourths. More than two-fifths of the trade flows through the New York customs district. Other important eastern gateways are Boston, Philadelphia, Baltimore, and Norfolk. Galveston and New Orleans compete for leading position on the Gulf Coast and handle three-fourths of the trade. San Francisco, Seattle, Portland, and Los Angeles are the leading Pacific Coast ports, but the total trade of the Pacific Coast is less than half that of the Gulf Coast.

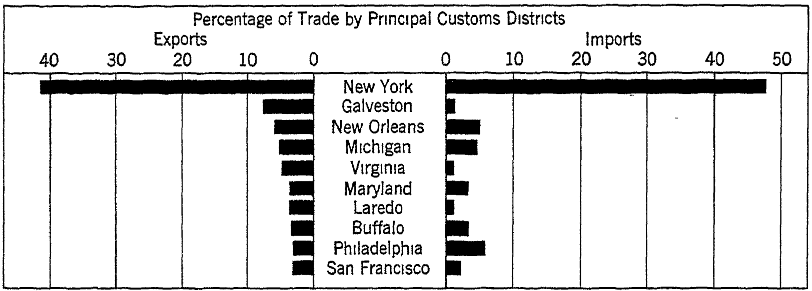


Fig. 41. Trade of United States by principal customs districts. The New York district handles more than two-fifths of the total exports of the country and nearly half the imports.

The preeminent position of the port of New York in overseas commerce is due to a number of influencing factors: (1) It has access to the rich hinterland previously mentioned, principally through the Hudson-Mohawk route by easy grades, but also by rail via the southern routes. (2) It has an excellent harbor open throughout the year with a developed waterfront of more than 350 miles, measured around piers and heads of slips, and a total potential frontage, including shore line, of 995 miles. (3) It is on the main transatlantic trade route over which most of the trade flows. (4) It is the financial center of the country. (5) It has all types of facilities needed in handling foreign trade on a large and expeditious scale.

Commercial Future. The future development of overseas trade depends very largely upon the same factors that make possible the leading position of the country in agriculture, mining, manufacturing, and transportation, which have been discussed elsewhere in this chapter. With a rich endowment of essential natural resources, with intensive production yet to be attained, and with good, well-equipped harbors accessible to that richly endowed hinterland, it seems reasonably certain that the United States will continue to hold a large share of the world's trade.

SUMMARY

With a great extent of level, varied, and fertile arable land; a healthful, invigorating climate highly favorable to abundant food production of high quality and great variety; an abundance of all essential minerals high in quality and readily accessible; an abundance of commercially available mechanical power; superior transportation and communication facilities; good harbors favorably located in relation to productive area and to principal world markets; a topography that favors unity rather than sectionalism; an ethnic stock derived from the most progressive peoples of the world; an educational system that tends to raise the general ability of the masses to a high level; a strong, stable government that rests upon the will of the governed and functions for their welfare, the United States offers a home to man in which he should be able to live on a high standard and contribute to the welfare of the world and the advancement of the human race more effectively than have the people of any other land. Of such a country one should be proud to be a citizen, and such an appreciation should come from knowledge of the opportunities for human well-being offered. "Our Own United States" continues to be the land of opportunity for better living, primarily because of the abundant natural resources available to man. The use he makes of them depends upon himself—the human factor.

PROBLEMS

1. Will the United States wield as great an influence in human welfare of the world in the future as Europe has in the past?
2. Are geographic or human factors most important in the development of a nation?
3. Can the United States maintain twice its present population with the same standard of living?
4. Have the agricultural or the power and iron resources been most important in the development of the United States?
5. Will the large water-power resources of the North Pacific States make them the leading manufacturing section of the future?
6. If Europe were organized as a single nation, would it be a better home for man than the United States?
7. Has agriculture or manufacturing wielded a greater influence in the development of the United States?
8. Can the United States maintain its position as the leading agricultural and manufacturing nation of the world?
9. Had wiser British policy prevailed in our colonial period and the present United States area remained in the British Empire, what effect might it have had on the status of Great Britain and the Empire?

CHAPTER 3

The Physiographic Regions of the Northeastern States

Topography Related to Human Activity. The Northeastern States are considered to be that group east of the Hudson-Champlain Depression—New England, together with New York, Pennsylvania, and New Jersey. The Census Bureau and the Department of Agriculture deal with this division in their statistical reports on the United States by sections, thus giving some justification for our use of the Northeastern States as a unit for study. But of far greater importance is the fact that here the northern colonies of early American history were located, and here began a differentiation of economic activities that distinguished them from the southern colonies. Here also today one finds a congestion of population, intensification of manufacturing and agriculture, great wealth, and some of the greatest educational institutions of the country, as well as great diversity in economic activities and in cultural landscapes, rural and urban.

The dominating elements of the natural environment of the Northeastern States that have tended to set them off as a unit is their location on the North Atlantic near to natural trade routes connecting them with the mother countries of Europe; and their rough and broken surface features. To the student of the geography of this section, the physiography forms the background for a scientific study of the distribution and character of human activities and accomplishments. Coastal plain, outwash plain, alluvial plain, lake plain, flat plateau, rolling plateau, dissected plateau, glaciated mountain area, glaciated igneous rock, glaciated sedimentary rock—all of these have their characteristic natural and cultural landscapes. Minerals and their related industries, coal power, water power, the location of traffic lines, the distribution and nature of harbors, and various economic activities, even the fishing industry also have a definite relationship to the physiography of the land. Thus, in order that the student may the better localize and interpret the diverse human activities and the cultural landscapes, attention is called to a brief consideration of the physiographic divisions of the Northeastern States.

Physiographic Divisions, Provinces, and Sections. The major physiographic divisions of the United States represented in the northeastern states are the Atlantic Plain, the Interior Plains, and the Appalachian Highlands. To the southeast and extending from Cape Cod through New Jersey is the Atlantic Plain, and to the northwest bordering the lakes is the Interior Plain. By far the greatest part of the Northeastern States lies within the Northern Appalachian Highland division (Fig. 42).

These major physiographic divisions are further subdivided into provinces and sections. Only the Embayed section of the Coastal Plain province is representative of the Atlantic Plain. Likewise only the Eastern Lakes section of the Central Lowlands province is representative of the Interior Plains. The larger provinces of the Appalachian Highlands are as follows:

1. New England province.
2. Adirondack province.
3. Appalachian Plateau province (Alleghany section).
4. Appalachian Ridge and Valley province.
5. Piedmont province (Piedmont Upland and Triassic Lowland).

From the standpoint of geologic age the Appalachian Highlands may be divided into three portions: (1) The Adirondacks, which belong to the Laurentians of Canada, and some of the most ancient of lands, and consist of granites, crystalline limestones, and schists. (2) The Older Appalachians (yet younger than the Laurentians) include the New England province, the Piedmont, and Triassic Lowland. They are composed of old rocks such as granite schists and slates. (3) The Newer Appalachians consist of the Allegheny Plateau, the Ridge and Valley section, and the Great Appalachian Valley. Here the rocks are limestones, sandstones, and shales. It will be noted that the Older Appalachians and Adirondacks occupy the larger part of the area towards the north and east, whereas the Newer Appalachians dominate the area in the south and west.

The Atlantic Coastal Plain. The Atlantic Coastal Plain includes Cape Cod peninsula, Nantucket and Martha's Vineyard, Long Island, and all of New Jersey southeast of a line from New York Bay to Trenton.

Cape Cod peninsula and the three islands just named have been the scene of glacial deposition, their surface features being characterized by morainic hills (knob and kettle type), mostly of sand, and outwash plains of sand and gravel.

The outlines of Cape Cod and the glacially deposited islands to the west have undergone some changes since glacial times. Waves and alongshore currents have built barrier beaches and bars across the mouths of bays, and on the eastern coast of Cape Cod a vast amount of till has been removed and carried northward and northwestward around the end of the glacially deposited Cape Cod peninsula, forming an intricate series of hooked spits with enclosed lagoons and marshes. The wind has also been

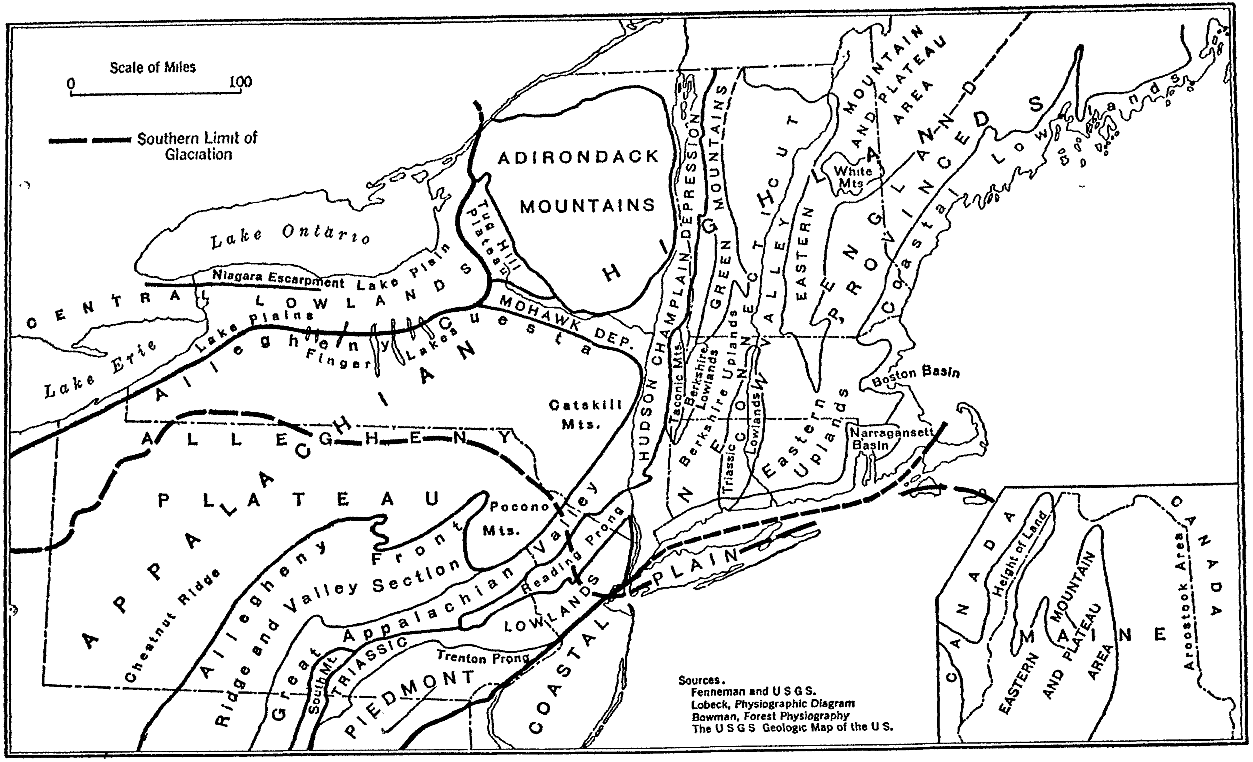


Fig. 42. The physiographic regions of the Northeastern States. Boundaries mainly from Fenneman's Monograph.

active on Cape Cod, and much of the low surface of the sandy spits has been built up by sheets of sand and dunes, the dunes huge billows of sand. Provincetown is built on the southern side of a newly formed spit (Fig. 43).

The inner edge of the Coastal Plain in New Jersey is marked by the Fall Line that extends in a fairly direct line from near New Brunswick, near the mouth of the Raritan River, to Trenton, and on along the Delaware River to Delaware Bay. The Fall Line lies in a lowland. To the northwest the lowland is carved in shales and sandstones, farther on trap caps several isolated ridges; to the southeast the lowland, which stands slightly lower, is cut out of limestone deposits. The two parts form the Inner Lowland of New Jersey. About 90 per cent of the population of New Jersey lives on this inner Lowland. Here are most of the large cities, most of the factories, and most of the railroad lines of the state. It is a part of that great thoroughfare that connects New York and Philadelphia, undoubtedly the most traveled strip of country in the United States today. Along this Inner Lowland passed the trails of the Indians in pre-Columbian days. Post roads traversed it in colonial times. In the softer limestone was dug the Delaware-Raritan Canal, to be paralleled only a few years later by one railroad line, and later by many. To the southeast of the Inner Lowland is the thinly settled New Jersey Coastal Plain.

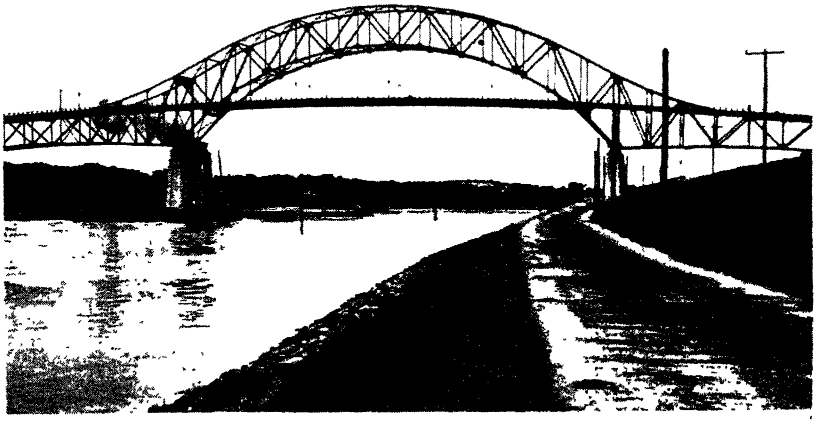


Fig. 43. Bridge over Cape Cod Canal. *Photo by Miller.* This sea-level canal, 12 miles long, excavated across the narrow strip of land between Buzzards Bay and Cape Cod Bay, shortens the distance from Boston to New York by boat. The route around Cape Cod is dangerous at times.

Drowning of the eastern coast of the Northeastern States brings ocean waters to the edge of the New England Plateau from Cape Cod northward. Farther south, this process, for the most part, gives origin to Buzzards Bay, Narragansett Bay, Long Island Sound, New York Bay, the swamps of eastern New Jersey, and Delaware Bay. Because ocean vessels may tie up at wharves on the edge of the old land at New York and Philadelphia, commerce moves around both ends of the Coastal Plain area of New Jersey. It is not, therefore, a transit region, and there is not the demand for modern roads and railroads that there is over the lowlands on its inner border.

About three-fifths of the area of New Jersey is in the Coastal Plain; yet a much smaller fraction, relatively, of the agricultural products of the state comes from there than from the other sections, for the soil is for the most part sandy and loamy and has been so thoroughly worked over by the waves and currents during its deposition that the percentage of soluble material is low. The surface is a plain sloping southeastward toward the ocean. The inner portion of the plain is highest, and here west-flowing streams have dissected the land. The lower courses of the east-flowing rivers are drowned and, therefore, have marshy borders and enter shallow marshy bays and lagoons, separated from the ocean by barrier beaches. There are no large cities on the Coastal Plain in New Jersey except Camden, and that is geographically a part of Philadelphia. Along the east coast are many resort towns. Long Beach and Atlantic City are the largest, their importance being due to the excellent bathing facilities and the nearness to large population centers.

Along the railroads that have direct connections with the large manufacturing cities, particularly in the marl belt near the western border, there are truck gardens, for the soil is easily worked, aerates well, drains well, is warm, and when well fertilized is suited to the growing of crops that do not demand rich soil for profitable yields. Large areas too sandy and too distant from shipping points to be profitably farmed are undeveloped, and are covered with forests of pine. In such sections one finds people living in isolation and poverty, in striking contrast to the wealth to be found in the Inner Lowland.

The Lake Plains. The Lake Plains of the Central Lowland occupy that small part of the states of New York and Pennsylvania which borders on the Great Lakes. They extend from the Thousand Islands exit of Lake Ontario southward and westward, along the lake shores, sometimes having a width of about 50 miles in New York State but narrowing to less than 10 miles on the Erie shore in Pennsylvania.

These plains are lacustrine in origin, in the main—that is, they are areas covered by former extensions of the Great Lakes when the St. Lawrence outlet was blocked by ice and the lake waters rose to higher levels and covered larger areas than the present lakes. The otherwise uniform slope of the plains towards the bordering lakes is broken by stream erosion, and by numerous kames, elongated gravelly hills known as drumlins, old beach lines, and other evidences of glacial deposition. The only major feature of the surface of the Lake Plains resulting from the rock structure in the province is the steep, northward-facing Niagara Escarpment which begins in New York east of Rochester as a low bluff and extends westward increasing in elevation to more than 200 feet where it was cut by the Niagara River to form Niagara Falls. This escarpment is due to erosion of the resistant Niagara limestone and its dipping southward.

The Lake Plain in New York joins the Mohawk Depression toward the east and marks one of the important outlets of the glacial lakes which followed immediately a recession of ice to expose this low route leading to the Hudson River and the sea, while the lower St. Lawrence was still blocked. Man has taken advantage of this low route for building the Erie Canal, railroads, and highways, which have been so important in linking the interior with the eastern seaboard.

The New England Province. The New England province as a whole is an upland or plateau sloping southward, as the trend of the rivers indicates. The highest parts are in the north and west, the upland surface here reaching 2000 feet or more, with a few mountain peaks attaining heights of 3000–6000 feet. Crystalline rocks are the basal formation, and outcrop in various parts of the province, the larger areas being found in southern Maine, the White Mountains, Rhode Island, and the Green-Hoosac Mountain range. The whole province was once peneplained, later tilted and slightly warped, dissected, the dissection being more pronounced in the north than in the south, and lastly glaciated. The less resistant rock areas have been worn into basins. Above the general level of the plateau are a few residuals or monadnocks which owe their height more to their location on stream divides than to superior hardness. Long before the erosive forces had formed the peneplain there had been warping, close folding, and faulting, so that many of the igneous and sedimentary rocks were metamorphosed into schists, gneisses, slates, marbles, and conglomerates. Limestones, shales, and sandstones, however, are to be found in some parts.

There are several recognizable subregions of the New England province. The Eastern Mountain and Plateau area is a broad upland which reaches its greatest height and development in the White Mountains but which also has, above the general level, Mount Katahdin, Saddleback, and other peaks in Maine. This upland extends southward through New Hampshire, across Massachusetts, and dies out in northern Connecticut (Fig. 44).

The Green Mountain region, represented in Vermont by the Green Mountains, in northern Massachusetts by the Hoosac Mountains, and farther south, extending into Connecticut, by a broad plateau surface, forms a western mountain section. The core of the Green Mountains in Vermont is a very ancient rock, but on the western flank there are marble deposits, derived from folded and metamorphosed limestones, that have long been quarried. The well-known Barre granite region lies on the eastern flank of the mountains.

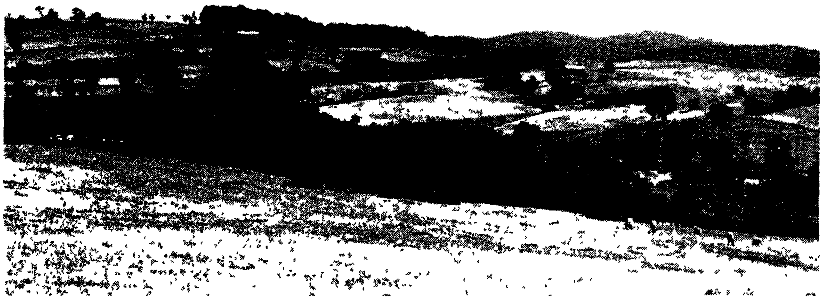


Fig. 44. A landscape in the New England Upland of central Massachusetts. *Courtesy, Berkshire Chamber of Commerce.* In this scene the slopes are gentle and the land is generally farmed or pastured everywhere. Higher wooded hills may be seen in the distance.

The Green Mountains are highest in central Vermont to the north of Rutland, and, although they are barriers to transportation and communication in some sections, they are crossed in northern Vermont by two river valleys of low gradient; and in southwestern Massachusetts and northern Connecticut the ascent to the crest from either east or west is gentle. The Hoosac Mountains proved a barrier to canal making, and the builders of the first railroad from Boston to Albany had to construct the famous Hoosac Tunnel to avoid steep grades. The Mohawk Trail, a famous automobile road, crosses the Hoosac Mountains at an elevation of more than 2000 feet. In the days when Vermont was being taken up by settlers from both New England and New York, the New Yorkers, recognizing the effectiveness of the Green Mountains as a political boundary, strove to include western Vermont, west of the mountains, within its jurisdiction; this brought on a broader warfare in which the "Green Mountain Boys," who fought to make Lake Champlain the western boundary, were victorious.

Between the Eastern Mountain and Plateau area and the Green Mountains lies the broad valley of the Connecticut. This valley is partly due to warping, but the structural form has been further deepened and widened by stream and glacial erosion. During late geologic times the southern end of the Connecticut Valley in Massachusetts and Connecticut was warped below the level of the sea, and sand and mud were deposited. Sheets of igneous rock were intruded into these sedimentary rocks. Later the whole was elevated, faulted, tilted, and eroded; and today this lower valley is a lowland, the Connecticut Lowland, with ridges capped with igneous rock forming conspicuous features of the landscape.

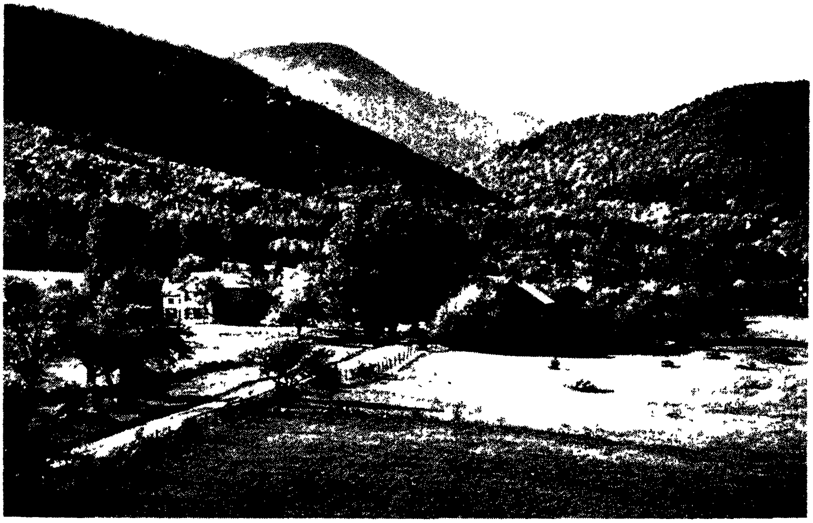


Fig. 45. A landscape in the Berkshires near Cheshire, Massachusetts. *Photo by Bartlett Hendricks.* These hills have rock cores, but glaciation is much in evidence in the form of sand and gravel. Boulders are commonly seen. The hills are wooded, and agriculture is confined to the valleys.

Along the western border of the New England province is a third mountain subregion, the Taconic Mountains, a part of the Newer Appalachians. This is a much-eroded, folded mountain region. There are ridges of varying lengths of hard rock, separated by valleys carved in limestone. Between the Taconic ridges and the Green-Hoosac Mountain region[1] is another depression, floored with limestone. It is called by some the Berkshire Lowland (Fig. 45).

The Connecticut Lowland, the Berkshire Lowland, and the Lake Champlain Lowland, together with the Boston Basin and the Narragansett Basin, have the best agricultural lands in New England and, in the westward expansion of the New England people, were taken up by farmers before the bordering uplands.

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[1] All the hill and mountain land of Berkshire County, western Massachusetts, is called the Berkshire Hills or the Berkshires.

Effects of Glaciation. No agency in the physiographic history of New England has exerted a more profound influence on human geography than the glacier. The main topographic features sketched in the preceding pages were little affected by the southward-moving ice, but most of the minor surface features owe their origin to glacial processes. Although there are bare ridges and ledges here and there in New England, most of the land is mantled with morainic material of fluvio-glacial deposits. In many parts of New England, particularly in southeastern New Hampshire and eastern Massachusetts, drumlins are common. Most of the islands of Boston harbor are drumlins. Some of these drumlins have been cleared and are tilled, but most of them are too stony for any use except as forests or pasture lands.

In general, the soil is thin on the upland hills, ridges, and mountains, and on these areas of thin soil one finds most of the abandoned farms, the increasing number of which has attracted the attention of so many students and writers for three-quarters of a century or more. To most students the abandoned-farm phenomenon is only a natural economic adjustment to the opening of the Middle West and the shifting of New England interests from agriculture to manufacturing. After the Revolutionary War, for 40 or 50 years, land in southern New England was scarce and many farms were established on the uplands where general farming and domestic economy did not demand an intimate contact with markets. The hill towns and hill farms were at their zenith about 1820-1830, and many farms were taken up that would not have been had there been easy access to the West. The upland farmers were "marginal" farmers, who succeeded when there was little competition; but, when the canal and railroads brought the products of the cheap lands of the Middle West to eastern markets, they were forced to better lands or to the cities. Many farms were worn out by one-crop agriculture, erosion, and excessive leaching. The farmers on the betters lands of the valleys and lowlands likewise felt the pressure of cheap western products but adjusted themselves to the new order by intensifying their agriculture. Other factors also led to the abandonment of farms. The railroads, when built in New England, avoided the hill lands. The more progressive of the young men and women left the isolated, primitive rural districts for the greater opportunities and comforts to be found in the rapidly growing cities, and preferred to remain there. Many families, because of better wages in the factories, abandoned the farms, and many farms were lost on mortgages. The Civil War hastened the movement. Many families were broken up by the loss of the male workers. Some veterans purchased homesteads in the West. Prices of farm products were low, and credit was difficult to secure. The abandonment of the hill farms is no more striking than the decadence of the hill towns; both are due to about the same causes.

Since probably as much as 75 per cent of the material of the drift has on the average not been moved more than 50 miles, it is the local bedrock that determines largely the mineral composition of the soil in any section. (See Fig. 46.) New England has little of the limestone and feldspathic rocks from which the best glacial soils are derived. The soil is everywhere made up mainly of crystalline material and is surprisingly uniform over large areas, because there is great uniformity in the bedrock. In mechanical composition the soils vary from loam to stony loam. Scattered rocks and boulders of large size in many sections make the use of farm machinery difficult.

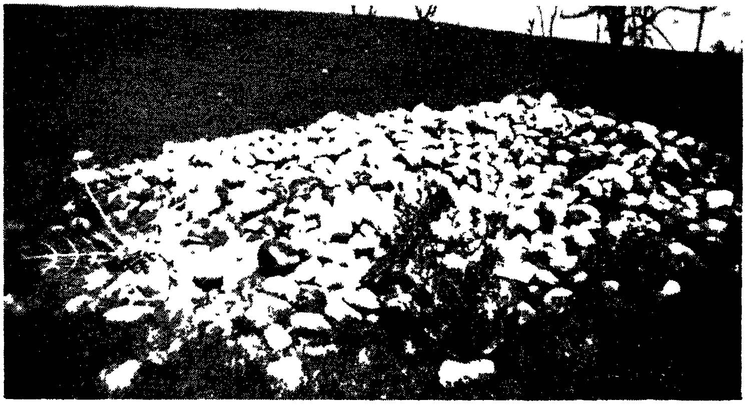

Fig. 46. A pile of boulders taken from a field in New England. Much of the mantle rock in the Northeastern States consists of glacial clay, sand, gravel, and boulders from which the soil has been derived. Agriculture required not only that forests be cleared from lands but that stones be removed because they interfered with tillage. This accounts for numerous rock piles at edges of fields, in gullies, and other out-of-the-way places, as well as the use of boulders for making fences. *Photo by Hudgins.*

The rough topography and the thin soils of northern New England protected the forests here from the early onslaught experienced in those portions of the United States having good agricultural lands. New England, in the three centuries since the founding of Plymouth, has furnished pioneer farmers for the vast agricultural area to the west, from the Atlantic to the Pacific. Some have migrated 3000 miles, crossing deserts and mountain ranges, yet they are only now invading a few of the northern valleys of New England with the plow. The lumberman still dominates the economic life of the north, and if a sensible forestry is followed he will continue to hold his own.

Glacial lakes are numbered by the thousands in New England (Fig. 47). There are probably more than 1000 in Connecticut, and an even greater number in Maine. Only a few are large enough to be shown on small-scale maps. Lakes add greatly to the scenic beauty of the landscape, are admirable natural reservoirs for municipal water supply, furnish sites for summer homes, are storage basins that serve to regulate the flow of streams, and are thus of particular benefit to factories using water power (Fig. 48).

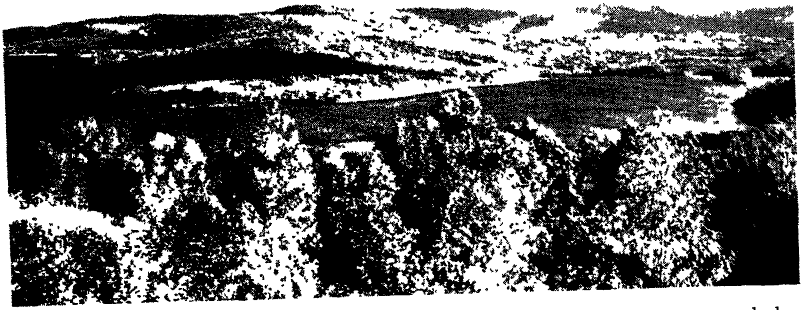

Fig. 47. A landscape in western Massachusetts. *Photo by Arthur Palme* A typical glacial landscape of New England—rounded hills, undrained depressions, marshes, and lakes. Agriculture is possible on much of the lowland and slopes.

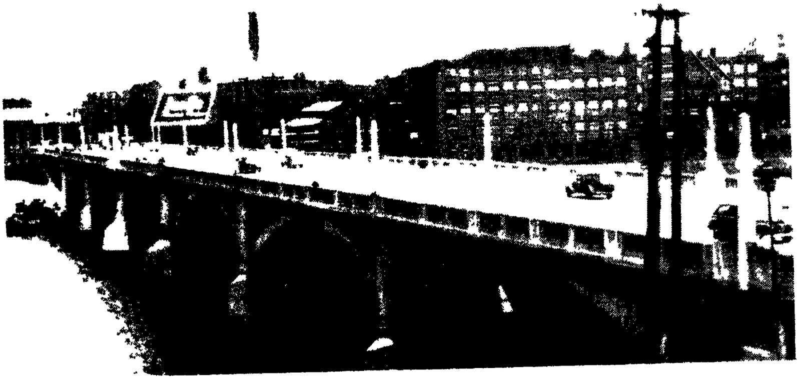

Fig. 48. Bridge over the Merrimack River at Lawrence, Massachusetts. In the background are factories localized by water power.

The sea interests have been benefited by glaciation, a partial compensation for the meager opportunities in agriculture. Ice scouring has been a factor in harbor making along the rock coast from Salem northeastward, and the "Banks" of northeastern North America, thought to be due to glacial deposition, favor the fishing industry. The glaciers of the the Ice Age, therefore, affected all the major economic interests of New England—agriculture, lumbering, fishing, manufacturing, and commerce.

The Adirondack Province. Similar in many respects to northern New England in its physiographic conditions and economic interests is the Adirondack province, an outlier of the Laurentian Plateau of Canada. The region long remained unsettled and little visited by whites, even after the surrounding lowlands had fine farms. But because of its proximity to the great cities to the south and to the long-traveled routes on the east, south, and west, and because of its wildness, beauty of scenery, and excellent fishing and hunting, it has become in recent decades a great playground. It can now be traversed along many routes; hotels and club houses are numerous; and there are many beautiful summer homes on large estates. Forests cover most of the surface and are held by large lumbering companies and hunting clubs, or by the state as forest reserves. The bedrock is largely crystalline limestone and several forms of granite. The whole was thoroughly glaciated, as the rounded surfaces, scoured basins and valleys, ice-molded hillocks, and morainic deposits show. There are a few high peaks, Mount Marcy having an altitude of 5344 feet, and Whiteface about 4900.

Newer Appalachians. In the Middle Atlantic States the Newer Appalachians are represented by the Allegheny Plateau and the Great Appalachian Valley, and the Older Appalachians by the Piedmont Plateau.

The Allegheny Plateau. The Allegheny Plateau, the eastern edge of which is the Allegheny Front, varies in width from 125 to 200 miles. The western edge has no definite name, but is represented nearly everywhere by a low, yet distinct, escarpment from central Ohio northeastward, the location of which is indicated on Fig. 42.

The Catskill Mountains, overlooking the Hudson Valley, are on the dissected edge of the Allegheny Plateau at its northeastern border. The horizontal stratified rocks—shale below, sandstone above, and conglomerate on the summits of many of the ridges and peaks—have many joints along which erosion has been rapid, giving rise to numerous valleys. Within the shales and sandstones are rocks of varying hardness outcrop along the valleys, and thus rapids are numerous in the channels of the streams, and ledges on the valley sides. Not being suited to agriculture, the region supports a scantier population than the nearby lowlands, but the beauty of the scenery and the proximity to New York City have brought a lucrative tourist and resort business in recent decades. One of the main ranges of the Catskills, a dissected ridge extending northwest and southeast, has a length of about 35 miles. The higher peaks vary in height from 3800 to 4200 feet.

The Allegheny Front sweeps across Pennsylvania from the southern boundary northeastward, in a broad curve as far as the forks of the Susquehanna. From there northeastward, its outline is not so regular. From the southern border to central Pennsylvania, the continuity of the Front is unbroken except by small stream valleys with separating spurs. Seen from the plains to the east, it looks like a serrated mountain ridge. It is still known to many as the Allegheny Mountains. The West Branch and the North Branch of the Susquehanna, as well as their tributaries, pierce the Front from central Pennsylvania eastward by deep, broad valleys, and along these valleys the easiest routes to the plateau are found.

The surface of the plateau is thoroughly dissected, especially near the major drainage lines. Here the valleys are deep and the slopes so steep that many areas have been left in forest, or, if tilled, have suffered greatly from soil wash and gullying. On the large interstream areas, the land is gently rolling; such surfaces are found just west of the crest of the Allegheny Front. The rocks of the plateau lie practically horizontal or only gently warped, as in Chestnut Ridge and Laurel Hill in southwestern Pennsylvania.

The Appalachian Valley. Most of the Appalachian Valley province is a series of limestone and shale plains separated by numerous, long, even-crested ridges that have in general a northeast-southwest trend, roughly paralleling the Allegheny Front and the western edge of the Piedmont Plateau. These ridges are composed of sandstone and conglomerate, the same formation occurring in several ridges. The strata in the ridges stand at a steep angle, showing that they are parts of great folds. The ridges are pierced at intervals by water gaps of streams that flow at right angles to their general trend. There are unbroken stretches of ridges of 20–40 miles, and some single ridges, like the Kittatinny Mountain, extend for 200–300 miles. This particular ridge was the first of the barriers to be met by the westward-moving settlers from Philadelphia in the early eighteenth century. Beyond this "Endless Mountain," the settlers on their way to western Pennsylvania met with many other barriers. Along the Pennsylvania Railroad from Harrisburg westward to the Allegheny Front west of Altoona, one may count ten or twelve separate ridges.

Some of the limestone plains of the Appalachian Valley province are almost entirely enclosed by ridges, the only low-gradient route for ingress and egress being along the drainage line. Such plains are known to physiographers as canoe-shaped valleys. Some of the ridges have a zigzag course.

The eastern portion of the Appalachian Valley province, lying to the southeast of the Kittatinny Mountain, is a long limestone lowland, generally known as the Great Valley. In southern Pennsylvnia and Maryland, it is called the Cumberland Valley; and in eastern Pennsylvania, the Lebanon Valley. It continues on northward to the St. Lawrence Lowlands. It is known as the Wallkill or Kittatinny Valley in Northern New Jersey, and as the Hudson Valley and Champlain Lowland farther north.

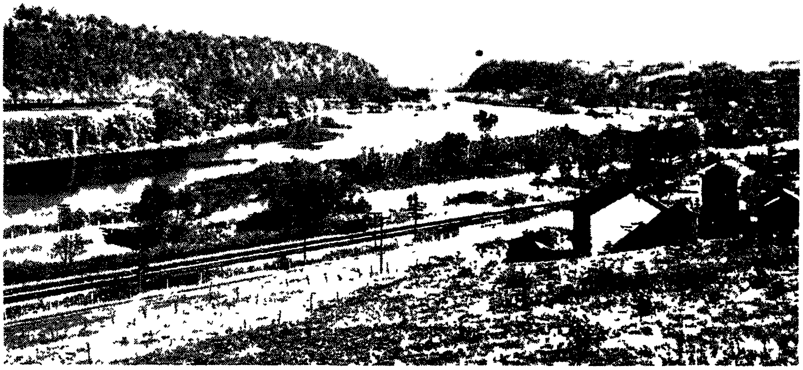

Fig. 49. The Mohawk Valley as a traffic route. *Courtesy, New York Central Railroad.* Here one sees hard-surface highways, railways, telegraph and telephone lines, as well as the river which forms the way for the Erie Canal, now known as the New York State Barge Canal. The Mohawk route offers the lowest grades and altitudes of any of the passes across the Appalachian Highlands.

The Appalachian Valley province throughout its extent in the Northeastern States offers excellent opportunities for agriculture, and where ready access is had to markets supports a dense rural population.

The Mohawk Depression. Cutting across the Appalachian Highlands between the Adirondacks and the Allegheny Plateau is the Mohawk Valley, which connects the Hudson Valley with the eastern Lake section of the Central Lowland in western New York. This valley is a great thoroughfare between the Great Lakes and tidewater at Boston or New York, and is, like the New York-Philadelphia thoroughfare discussed previously, an inner lowland carved out of the softer strata that skirt the southern border of the Adirondacks. It is an area of prosperous farms and thriving cities and is traversed by hard-surface roads, the New York State

Barge Canal-Erie Division, several railroads, and telegraph and telephone lines. It and the Hudson River Valley form the lowest route across the Appalachian Highlands, from the Canadian border to Central Alabama (Figs. 49, 50, and 51).

The Piedmont and the Various Prongs. The Piedmont Plateau in Pennsylvania and New Jersey covers only a small area and is unlike the piedmont in the southern states in that metamorphosed igneous rock has a smaller surface exposure than sedimentary rocks. The Blue Ridge extends northward into southern Pennsylvania as a ridge, but dies out near Carlisle. This is known as the Carlisle Prong (South Mountain). In southeastern Pennsylvania the crystallines outcrop over a much larger area but terminate northward near the Delaware River at Trenton. This is called the Trenton Prong. A tongue of the crystallines of New England crosses the Hudson Valley to the north of the Palisades, in northern New Jersey, and extends into Pennsylvania in a narrow belt on to Reading. This is called the Reading Prong. Another less distinct tongue of the crystallines of New England underlies Long Island Sound and outcrops on Manhatten Island, where it offers solid rock foundations for tall buildings in New York, but renders construction for subways and buildings very expensive. This is called the Manhattan Prong.

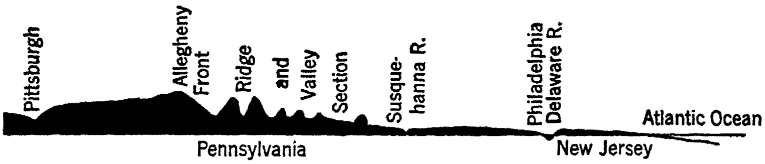

Fig. 50. Profile of land features from Pittsburgh to Philadelphia. (Vertical scale about fifty times horizontal.)

Between these prongs lies a lowland similar in geologic history, bedrock, and surface features to the Basin of Minas in Nova Scotia and the Connecticut Lowlands. The lowland of Pennsylvania is a repetition of the lowland of Connecticut; drowning, and possibly some glacial erosion, has placed a portion of it beneath Long Island Sound; but in northern New Jersey its surface, as earlier shown, forms a part of the Inner Lowland. Trap ridges and isolated hills occur in the lowland of the middle Atlantic states as in the Connecticut. The Palisades of the Hudson and the trap ridges of northern New Jersey and about Gettysburg represent the largest exposures of these igneous rocks. At Gettysburg trap ridges and hills figured largely in the Union defenses that broke the strength of Lee's invading army.

The sandstones and shales of the lowland in Pennsylvania were deposited in troughs in the Piedmont Plateau. These rocks weather into a gravelly-to-sandy-loam type of soil locally known as the Indian red soils. The Piedmont soils are known as "gray lands" and are quite distinct from the "red lands" of the lowland.

Within the Piedmont crystalline rocks in southeastern Pennsylvania, in Lancaster County, is a large area of limestone, similar in age to the limestones of the Appalachian Valley province.

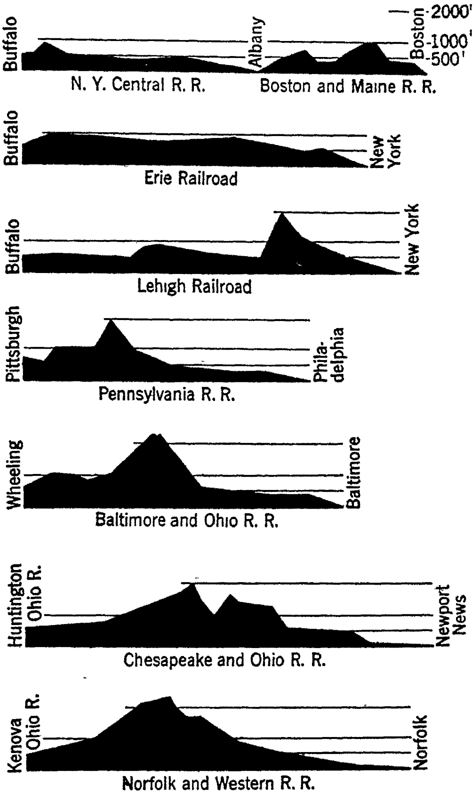

Fig. 51. Profiles of some transappalachian railroads. (Vertical scale about 140 times the horizontal.) The New York Central route is far superior to the others in the adjustment to surface features. Between Albany and New York the route is practically at sea level.

Glaciation in Pennsylvania and New Jersey. The effects of glaciation in Pennsylvania and New Jersey are not so far-reaching as in New York and New England, for only a small portion of these states was covered by ice. Long Island, as previously explained, owes its surface features and soils to the ice work. A lobe pushed southward down the Hudson Valley to the south shore of Staten Island. Northeastern and northwestern Pennsylvania were ice-covered, as was all of New York except a small area about the headwaters of the Allegheny River, the higher lands of the Allegheny Plateau retarding the southward movement. The Adirondacks and the northern edge of the Allegheny Plateau in New York suffered much erosion. River channels in the edge of the plateau were widened and deepened into long, narrow lakes, the Finger Lakes. Numerous drumlins were deposited on the level lands to the north of these lakes, and, in the northward retreat of the ice front, a series of glacial lakes of large extent, antecedents of Lakes Erie and Ontario, were formed, so that the soil of much of northwestern New York is lacustrine in origin. In much of New York the glaciers worked on softer rock than in New England; hence thin soils and bare ledges are less frequently met with, the Adirondacks and parts of the Catskills being exceptions.

EXERCISES AND PROBLEMS

1. It is the belief of geographers that New York has been greatly benefited in its growth in population, industries, foreign and domestic commerce, and business in general, in comparison with Boston and Philadelphia, by the closer contact it has with the great interior of our country. Show the truth or falsity of this belief. What is the physical basis of this easier contact? Work out graphs of population growth of these cities, of growth in foreign commerce, of railroad mileage, of manufactures. Data may be secured from the *Statistical Abstract*. Acquaint yourself also with the development of transportation lines to the interior. Which of these cities has the best local environment favoring growth? May not the difference in growth be due to the greater enterprise of the New Yorkers, past and present? Or is it a question of adjustment to opportunities? Is degree of enterprise a measure of the extent of natural opportunities with which man has had contact?

2. It is estimated that the railways to the west and south from New York City now carry a greater volume of shipment annually than do the railways which follow the Hudson-Mohawk Depression. Verify and account for this fact.

3. Where are the "playgrounds" of the Northeastern States? What physical features make them suited to such use and not to agriculture? Write to the various advertising bureaus of the railroads for booklets describing the attractions of the various "playgrounds." Try to determine what attractions are based on geography

4. Compile a list of all the effects of glaciation on the economic, commercial, and social life of the people living in the glaciated portion of the Northeastern States.

5. The text states that a depression of the coastal regions of these states has been of great value to New York and Philadelphia as ports. What would have been the consequences if the coastal lands, instead of being depressed, had been elevated, say about 400 feet above the present position?

CHA

Manufacturing in the Northeastern States

FACTORS OF LOCALIZATION

The northeastern group of states is the greatest manufacturing section of the country. Here manufacturing began early under the encouragement of numerous water-power sites, a dense population supplying labor and markets, and rough stony lands that did not encourage extensive agriculture. Although this section comprises only 5.5 per cent of the land area of the United States, it had 27 per cent of the population in 1949. At the same time, this section had 40 per cent of the wage earners engaged in manufacturing in the country, and it accounted for 37 per cent of the net value of manufacturing (Table VI).

TABLE VI

MANUFACTURING IN THE NORTHEASTERN STATES COMPARED WITH THAT OF TOTAL UNITED STATES

	United States	Northeastern States	Northeastern States Per Cent of U.S.
Area in square miles (land only)	2,973,000	162,000	5.5
Population	150,697,000	39,470,000	27.
Wage and salary earners	15,000,000	5,500,000	40.
Net value of manufacturing	$74,425,800,000	$27,604,400,000	37.

Practically every type of industry is represented in these states. Indeed, the variety of product, from the lady's wrist watch to the giant locomotive, from the coarsest cotton to the finest silk, from the deadliest and most powerful chemicals to perfumes, is one of the outstanding characteristics of this industrial development. *What are the natural advantages that make this group of states the greatest manufacturing section of the country?*

The Power Resources of the Northeastern States. The abundance of power resources and fuel is one of the outstanding advantages. Water power has all along been one of the factors that tended to localize factories. In colonial days, nearly every rapids and falls in southern New England, along the Hudson and Mohawk Valleys, in northern New

Jersey, and in southeastern Pennsylvania, had beside it a factory of some sort—sawmill, gristmill, carding mill, fulling mill, or blast furnace—or perhaps several factories, the power generally being supplied by an overshot water wheel. The numerous power sites in the glaciated portion of these states gave an opportunity for wide dispersal of factories in the early days when they were all small and required only a small stream of water for power. The power sites to be used first were near the coast, where the waters of the plateau fall over the edge of the plateau, the Fall Line. About these power sites, in time, great industrial cities grew up: Fall River, Providence, New Bedford, and others. The power sites in the interior are largely at boulder dams in the postglacial channels of the streams, at the edge of filled preglacial valleys where the course of the postglacial stream departs from that of the preglacial, and where streams flow from more resistant to less resistant rocks. The forest cover, the numerous glacial lakes and marshes, and a rainfall of 30–50 or more inches fairly evenly distributed throughout the year all tend to give the rivers flowing from or in the glaciated area a fairly constant flow.

Water Power of New England. New England industries and public utilities are now utilizing nearly to the limit the power of the rapids and falls which they have harnessed; indeed, the power actually developed and used in New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut (Table VII and Fig. 24) is in excess of the estimated available low-water horsepower, as determined by the usual method employed by the United States Geological Survey. Many a factory uses steam power to supplement water power and tide it over the low-water season.

The wide distribution of power sites tended to give the colonial factories a wide ~~distribution~~, and thus to make for "democracy" in the industrial world; but as large machines came to be built, as well as large factories equipped with a great variety of large machines, many a small mill beside small rapids or falls lost out, and industries came to be concentated at the larger power sites. Fortunately for some small power sites, the railroad came with coal, and a steam plant was used to supply the power needed for factory expansion; but this was not until about the middle of the nineteenth century. Even large plants at medium-sized power sites were checked in their expansion. The expansion of the textile mills at Waltham, Massachusetts, is a typical example. The first complete cotton factory of the state was built at Waltham in 1814, utilizing the power of the small Charles River. By 1820 the power capacity of the falls had been reached, and the company purchased a site on the Merrimack where the water has a fall of 32 feet. Here Lowell grew up, and came to have, in a short time, 33 mills. Before the invention of the dynamo-motor the factory utilizing water power had to be located at the falls, rapids, or dam, and thus the number of factories that could be secured by a power site was limited.

The installed capacity of the water wheels of Maine is 369,000 kilowatts. Most of the falls occur in the rivers where they flow down the eastern slope of the Eastern Mountain and Plateau area to the New England Upland. The numerous large lakes of the region are admirable natural storage basins. The Kennebec, Penobscot, and Androscoggin Rivers in Maine have large water-power developments used in the pulp, paper, and textile industries located there. The Merrimack River furnishes a large part of the power for the industries at Manchester, New Hampshire; and Lowell, Lawrence, Holyoke, Turner's Falls, Massachusetts, Vernon, Vermont, and numerous other industrial towns take a large part of their power from the Connecticut River and its tributaries. On the flanks of the Green Mountain region, from northern Vermont far into Connecticut, are numerous power sites.

The Deerfield River on the east slope in Massachusetts, alone, has plants that develop 58,000 h.p. Between 1800 and 1850, 27 paper mills were built on the borders of the Berkshire Valley on the west slope, all using water power. At the town of Lee alone, there were 18 mills; but, when the heavy Fourdrinier paper machines, which turn out sheets of paper miles long and which demand a great amount of power, came to be used, many of the small paper mills had to be abandoned. Abandoned power sites, with their picturesque overshot water wheels, and moss-covered factories beside a half-filled mill pond, were and still are in some parts of New England only a little less common than abandoned farms. Both represent adjustments to changing economic conditions.

Water Power of New York. On the Hudson, Black, and Oswego Rivers in New York are many large power plants. The numerous streams descending from the mountain and plateau borders of the Hudson and the Mohawk early furnished power for the gristmills, sawmills, and oil mills. Most of the larger sites have come to be utilized only lately. About the falls of the Genesee where the water power was used early in the nineteenth century to grind the wheat grown in the nearby region, Rochester grew up. The great industrial development here has far outrun the power resources of the falls, and coal is brought from the coal fields of Pennsylvania. The largest power plants in New York state today (except those at Niagara Falls) are at Spier Falls and Glens Falls on the Hudson, where 38,000 hp and 40,000 hp, respecitvely, are developed. At Cohoes, where the Mohawk falls 103 feet in a series of rapids as it enters the Hudson Valley, and at Little Falls, where there is a fall of 245 feet in a half mile, are important power plants. The Mohawk system alone has a potential water power of approximately 180,000 hp., less than half of which is developed. The most important power sites in North America are about Niagara Falls, although the "lion's share" of the power goes to Canada. On the United States side of the falls the plants have more than 560,000 hp capacity. The output is used locally in many plants, particularly in the electric chemical industries, and is distributed widely over western New York.

Power in Pennsylvania and New Jersey. The small power sites in both Pennsylvania and New Jersey were used early, as in New England and New York. Today there are large developments on the lower Susquehanna with immense turbines from which electricity is furnished to Philadelphia, Baltimore, Washington, and many smaller cities. The latest power development is just over the southern boundary of Pennsylvania in Maryland—the giant Conowingo with 11 turbines, the total capacity of which is about 360,000 hp. Many other sites are utilized on the Susquehanna, but, since most of Pennsylvania lies outside the glaciated area and has mature topography, the flow of the streams is not so regular as in New England. The Allegheny, Monongahela, and Youghiogheny all have much potential power. Hydroelectric plants are replacing the old water wheels. There are several plants now in operation along the Monogahela, and the resources of the Allegheny are about to be utilized.

New England and New York, both coalless, have made the most of their water-power resources; but Pennsylvania, rich in coal and still producing oil and gas, has had good reasons for its belated utilization of its water-power resources.

Superpower Systems. In order to make the greatest possible use of the power potentialities of the many electric plants in the Northeastern States or in a part of these states, both steam and water, great "superpower" systems, are being developed in which all the larger power plants and stations are to be connected so that electricity may be transferred from one plant or station to one or more of the others. These are not to be great monopolies but coordinated systems, each plant maintaining its identity but being able, if necessary, to secure electricity from other generating plants or dispose of its excess, and thus to meet the varying local demands. A great saving will result in the greater possibility of keeping the plants running at their full capacity all the time, and thus fewer plants will be needed. It is planned to have a closer coordination of electric and steam plant. The steam plants are to be run when excess demands call for their assistance. Early in 1924, 11 electric-power manufacturing companies, operating in Ohio, Pennsylvania, Virginia, West Virginia, and Maryland, agreed to organize their power plants into a superpower system to be known as the Coal Field Super-Power Group. This system can readily be connected with the power group being developed in other parts of the Northeastern States and even with the ones in use in the South.

Summary of Power Resources. The water-power resources of the Northeastern States are shown in Table VII.

TABLE VII

DEVELOPED AND UNDEVELOPED WATER POWER OF THE NORTHEASTERN STATES IN 1947
(in thousands of kilowatts)

State	Developed			Undeveloped	Total Potential
	Utilities	Industrials	Total		
Maine	246	122	368	2,448	2,817
New Hampshire	233	50	283	393	676
Vermont	161	15	175	303	478
Massachusetts	164	56	221	110	331
Rhode Island	3	10	13	—	13
Connecticut	87	18	105	94	200
New York	1,155	72	1,227	2,738	3,965
New Jersey	7	3	10	105	115
Pennsylvania	422	3	425	2,332	2,757
Total	2,478	349	2,828	8,523	11,351
Total for U. S.	14,971	985	15,956	77,130	93,086

It is shown that the developed power in the Northeastern States is 2,828,000 kilowatts. The power employed from all sources in the utilities and industries is more than four times this amount. Hence the potential water power (11,351,000 kilowatts), if completely developed, would not quite be enough to turn the wheels of all industries in these states. Coal, oil, and gas furnish most of the power for the many hundreds of industrial plants; and much of the coal, oil, and gas is furnished by the state of Pennsylvania.

The Coal Resources. In eastern Pennsylvania is the only important anthracite coal field now being worked in the world. From beneath an area of about 478 square miles, more than 50,000,000 tons of anthracite are mined annually, mainly from the mines along the Wyoming Valley from Wilkes-Barre through Scranton on to Carbondale and in a detached area of irregular shape from Hazleton southwestward to Shamokin and Pottsville. Reliable sources place the original reserve at 21,000,000,000 tons, one-third of which has been mined. Anthracite was first discovered in the Wyoming Valley in 1762, but it was fully half a century later before it was mined on a commercial scale. In 1820 only

365 tons were taken out; about 1840 it began to be mined on a large scale for fuel in blast furnaces. Most of the anthracite mined today is for domestic use, although many steam boilers in factories are heated with it in Philadelphia, New York, and other nearby cities. A large percentage of homes, even as far west as the Great Lakes region, are heated by anthracite.

In western Pennsylvania, there are about 14,000 square miles of coal lands, the annual output from which has been about 500,000,000 tons from 1940 to 1952, and the estimated available supply yet in the ground more than 100,000,000,000 tons. Pennsylvania produces about 23 per cent of the bituminous output of the country, and Pennsylvanian coal runs the larger portion of the factories of the Northeastern States, although coal from Ohio, West Virginia, and Maryland gets to some of them. The railroad is the chief distributing agent, carrying coal directly to the coal yards of cities, to factories, or to the seaboard for shipment by water. New England receives from 14,000,000 to 15,000,000 tons by coastwise vessels each year. A small amount is exported, and much used for bunkers. Canada gets 25,000,000 tons a year, mainly from Lake Erie ports by vessel. Coal from the northern Appalachian fields is transported as far west as the Pacific Coast and southward to the Gulf Coast. About 40 per cent of the total output of Pennsylvania is used within the state in coke making, on the railroads, and in the mines and factories. The abundance of coal enables western Pennsylvania to turn out many products, such as heavy machines, glass, and special steels, which could not be manufactured in sections where coal is scarce.

About half the bituminous coal of Pennsylvania comes from the Pittsburgh seam, a bed which is about 6 feet thick, having an areal extent of some 2500 square miles, and furnishing one of the best coals produced in America. It is hard, for bituminous, does not break up readily, and hence stands long-distance shipping and frequent transshipping. It gives 36-38 per cent of volatile matter in gas plants, makes excellent coke, and gives good results in furnaces in houses and factories. Much of the bituminous coal of Pennsylvania is obtained by drift mining, the outcrop occurring in the borders of the deep valleys that dissect the Allegheny plateau. The beds are very regular in thickness and quality of coal, are generally free from shale, and are practically horizontal. The larger part of the coal is mined by machinery. The mining of bituminous coal is therefore much easier than that of anthracite, which occurs in steeply inclined beds that have been folded and faulted. Some deposits of anthracite are reached only by deep shafts, and machines are little used. This is the chief reason for the high price of anthracite coal in comparison with bituminous.

Many explorers had made mention of the coal deposits of western Pennsylvania before the Revolutionary War. The British garrison at Fort Pitt, shortly after the French vacated Fort Duquesne, used coal for fuel. The pioneer farmers used it, many shiploads being floated down the Monongahela, and even the Ohio, before 1800. Commercial mining began shortly after 1820. Only 3080 tons of coal were mined in the United States in 1820; 286,000 in 1830; and only 1,850,000 in 1840. The output of the United States today is nearly one hundred times that of 1850. Until about 1850 Pennsylvania produced nearly all the commercial coal of the country.

Petroleum as a Raw Product, Fuel, and Power Resources. Western Pennsylvania and southwestern New York were, up to about 1895, the greatest petroleum-producing section of the country. In fact, the petroleum industry of the world had its birth in this region and it was here that the methods of drilling, pumping, transporting, and refining of petroleum, now in use the world over, were developed. The French explorer Charlevoix made mention of oil on the upper Allegheny. The Indians and early pioneers collected oil for medicinal purposes from the surfaces of the small streams. The first shipment from Pennsylvania went to New York City some time before 1850. It was bottled and used for medicine, the price received being $275. Various attempts were made to collect the oil on a commercial scale from the surfaces of creeks and ponds, but without success. Colonel Drake of New York made the first attempt (1859) to secure a larger supply by sinking a shaft, and then a pipe, to the "pool" from which the surface oil evidently came. This was a new venture, for nothing was known of the stratigraphy of oil deposits and little of well drilling. Fortunately the oil pool was reached at a depth of only 69.5 feet and oil came within 10 feet of the surface of the ground in the pipes. In the first 4 months, 2000 barrels were pumped from the well. This success of Colonel Drake incited others to drilling, and in a few months there were scores of wells. The drillers gained in experience, and deeper holes were attempted. A gusher was struck at a depth of 400 feet in 1861. In 1860 the production was nearly 500,000 barrels, and by 1861 more than 2,000,000 barrels. The supply soon came to exceed the demand, and prices fell. Before there could be much demand, uses had to be found for the oil, lamps invented to burn it, and refineries provided to prepare it for use. Until the development of the internal combustion engine and the era of the automobile, kerosene was the chief product the refiners made.

Eventually other fields were opened up, about 1885 in Ohio, 1890 in West Virginia; and by 1865 California was producing about 1,000,000 barrels a year. In the meantime the oil wells of Pennsylvania and New York declined. In 1920 Pennsylvania was producing only 7.1 per cent of the petroleum of the country, and in 1950 about two-thirds of 1 per cent. The many refineries established to handle the product of the Pennsylvania oil wells are now refining oil from every field east of the Rockies. Oil is the basis of a large refining industry producing kerosene, gasoline, and many by-products; but oil has also been, like natural gas, much used as fuel in the factories and has therefore been a factor in the localization of industries.

The Abundance of Natural Gas. Natural gas, called "the most perfect fuel nature furnishes us," was found in most oil pools and escaped from many wells. The first gas well was sunk in 1879. Since about 1890 gas has been widely used as fuel in iron and steel mills, and in the manufacture of glass, porcelain, and cement. It is a common domestic fuel in both country and city in western Pennsylvania. Natural gas has served to localize many factories. Being a cheap fuel and easily handled, it enabled gas-using factories to produce their products at low cost. Manufactured gas (coal gas) is sold for several times the price of natural gas.

Abundance of cheap coal, petroleum, and natural gas have for about half a century or more been important factors in encouraging industries in the Northeastern States, some parts, of course, being more favored than others. New England has been the least benefited, western Pennsylvania the most. Coal is used in all parts of this group of states, but oil and gas mainly where they are produced. New England has its water power to compensate for its lack of mineral fuel deposits and has specialized in products that require little fuel in their manufacture.

Since about 1940 the relative importance of coal as a source for fuel and power has decreased in the United States with an increase in the use of petroleum and natural gas. However, since petroleum and natural gas are more rapidly exhausted, the future will bring an increase in the importance of coal, as well as a dependence upon nuclear energy. The Northeastern States appear to be fairly well equipped for future sources of power.

Sources of Raw Products. Many of the raw products needed in manufactures occur in limited quantities and in great variety in the Northeastern States. The coniferous and hardwood forests (Fig. 20) have long supplied (now only a small part of the needs) raw material for saw and planing mills, pulp and paper mills, furniture factories, shipbuilding plants, and box and cooperage factories, as well as bark for the large tanning industry (Fig. 52).

Herring, cod, mackerel, oyster, and other fisheries off the coast furnish raw products for the canning, drying, smoking, and for the fish-oil and fertilizer factories. The canning industry uses vegetables from New Jersey and Long Island, berries from widely scattered areas, and peaches from northwestern New York, southern New England, and other sections. Grape juice and wines from the grapes of the Finger Lakes and Lake Ontario vineyards are well known over most of the eastern United States. Butter, cheese, and condensed milk are some of the products of the dairies. The wheat fields, although far surpassed by those of the Middle West, still furnish some raw material for the flour mills. New York and New Jersey still supply small amounts.

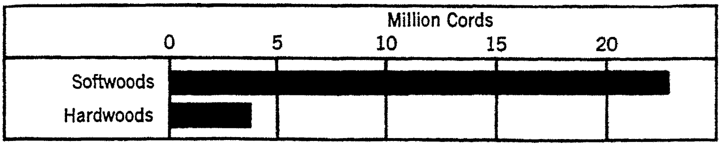

Fig. 52. Kinds and amounts of pulpwood consumed in the United States in 1951.

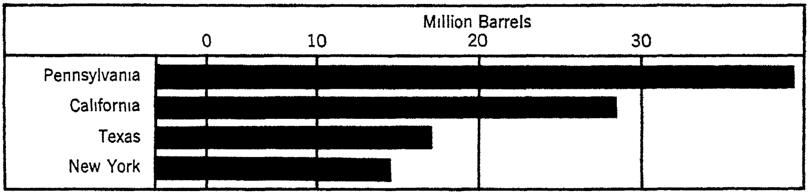

Fig. 53. Production of Portland cement in the United States by leading states in 1950.

From the widespread clay deposits the numerous brick yards secure their material, and the pottery works at Trenton once depended entirely upon local supplies of clay. The shale and limestone of the Lehigh Valley are the basic materials used in cement making. In this valley the first Portland cement of the United States was made about 1890; and today, even though cement making has become widely distributed, the Lehigh Valley is still the leading cement section of the country (Fig. 53). The proximity of many large cities in need of cheap and serviceable fireproof building material to the Lehigh cement section is another factor in the prominence that the cement industry holds in these states. The Hudson Valley also has cement plants utilizing local deposits of clay and limestone.

The Indians obtained brine from the salt springs of central New York, and ever since the arrival of the white man salt making has been an important industry of Onondaga County. It was an important factor in the early growth of Syracuse. Salt deposits have been struck by boring at many points in central and western New York. Brine pumped from Tully to Solvay near Syracuse is used, with limestone, in the manufacture of immense quantities of soda and allied products.

There are many other minerals of considerable commercial value which are directly or indirectly associated with manufacturing. In New England there are at present few minerals produced other than granite, slate, marble, limestone, basalt, and sandstone. Some of the granite and marble quarried is worked up into finished forms, cut, smoothed, and polished, at the quarries, but stone cutting and polishing is an industry in many towns and cities. Talc occurs in northern New York and Vermont. Graphite, used in the making of lead pencils and crucibles, is found near Lake George, New York. The gypsum of central New York is manufactured into plaster of Paris and other wall finishes. Mineral pigments—red, brown, and yellow ochre, green shales, and slates, and red iron ore—are ground for paints. Feldspar is utilized in the pottery industry. Indeed, in no other section of the United States is so great a use made of the products of the mine and quarry.

The great industries of these states today, however, textiles, and those utilizing iron, steel and other metals, leather, rubber, and paper and pulp, depend largely or wholly upon products brought into the section from other parts of the United States or from foreign countries. Most of the iron ore that makes Pennsylvania the greatest pig iron and steel-producing state of the Union comes from the Lake Superior region, with smaller quantities imported from Cuba, Venezuela, and other sources. Zinc and lead do occur in New Jersey but only in small quantities. The hundreds of plants turning out automobiles, steam and gas engines, locomotives, dynamos and motors, railroad coaches and cars, stoves, tools, builders' hardware, machines for use in the textile, woodworking, paper, leather and shoe industries, firearms, plumbers' supplies, and a thousand other products are using metals that have been directly or indirectly secured from other parts of United States and from foreign countries.

All the cotton and silk, and nearly all the wool used in the widely distributed and varied textile industries comes from outside these states. Most of the hides come from the slaughter houses of the North Central States or are imported from temperate South America, Australia, or elsewhere. More and more the pulp and paper industry is dependent on Canadian forests, and the woodworking industries on lumber brought from the South, the Pacific Coast, Canada, or the tropics. The necessity for importing so many and so much of the raw materials handicaps the industries but slightly if at all, for the factories and their reputation are already well established, power is plentiful and relatively cheap, and numerous and direct traffic lines give this section superior advantages in collecting raw materials and distributing the finished products. All the seaports of the Northeastern States were important commercial centers before they became industrial centers, and commerce today absorbs the energies of a large part of their people.

Strategic Location for Manufacturing. The position of these states on the border of the greatest commercial ocean, the Atlantic, is of supreme advantage. As a result of the sinking of the coast line and the formation of indentations that project back into the continent, the four largest cities, Boston, New York, Philadelphia, and Baltimore, although on the edge of the Appalachian belt, are on the ocean. Fortunately, the coastal plain that guards the eastern border of the old land from Cape Cod southward is dissected by estuaries, and these cities have every access to the world-ocean traffic routes. The contact that the Northeastern States enjoy with the ocean through the many harbors, and their position between the ocean and the great "heart" of America, the Great Central Plain, make them the greatest transit region of the American continent.

Equally important are the low passes of the Northern Appalachians, the lowest of which is the Hudson-Mohawk Depression that opens out upon the Lake Plains of western New York (Fig. 42).

The commercial contact with the Great Central Plain was not obtained without effort on the part of the northern seaboard cities, for the natural tendency of the trade was to move southward with the currents of the Mississippi and its tributaries and make New Orleans the great emporium of the Central Plain. Not only did the eastern seaboard cities struggle against geography to turn the traffic eastward, but they struggled also with each other. Although all benefited from this struggle, the one most favored by natural traffic lines benefited most.

Struggle for Commerce of Interior. In the first phase of the struggle for the control of the commerce of the Middle West, roads were built. In road building, Baltimore had the advantage as to distance, and, moreover, it was assisted by the National Government in building the National Pike from Cumberland, Maryland, to Wheeling, West Virginia, and beyond. Pennsylvania built the Philadelphia-Pittsburgh Pike; and New York, a road from Albany to Buffalo. All these were well traveled; along them moved as many of the products of the Middle West and the manufactures of the East as could stand high freight charges.

In the second phase of the struggle canals were dug. Boston, recognizing the great barrier the Hoosac and Taconic Mountains offered, made only a feeble attempt to get to the Mohawk Lowland.

Baltimore, financed by Maryland, started the Chesapeake and Ohio Canal and in time built it as far west as Cumberland, Maryland. Further progress was stopped by the Allegheny Front and the building of the Baltimore and Ohio Railroad, which was started in 1828. Philadelphia, assisted by Pennsylvania, pushed the Pennsylvania Canal and Portage Railroad to Pittsburgh, but not until long after New York had completed the Erie Canal along the Hudson-Mohawk Depression and across the Lake Plains to Buffalo. In canal building, New York led all the rest and was the first to get its artificial water line across the Highlands to the great productive interior. Moreover, at Buffalo the Erie Canal connected with the Great Lakes, which led a thousand miles back into the Great Central Plain. Canals were built to connect the Ohio River with Lake Erie, and thus the commerce of nearly all of Illinois, Indiana, and Ohio, as well as the states to the north, flowed eastward through the Erie Canal. Thus an immense area, rapidly being settled and developed, was made tributary to New York. The beginning of the leadership of New York dates from the opening of the

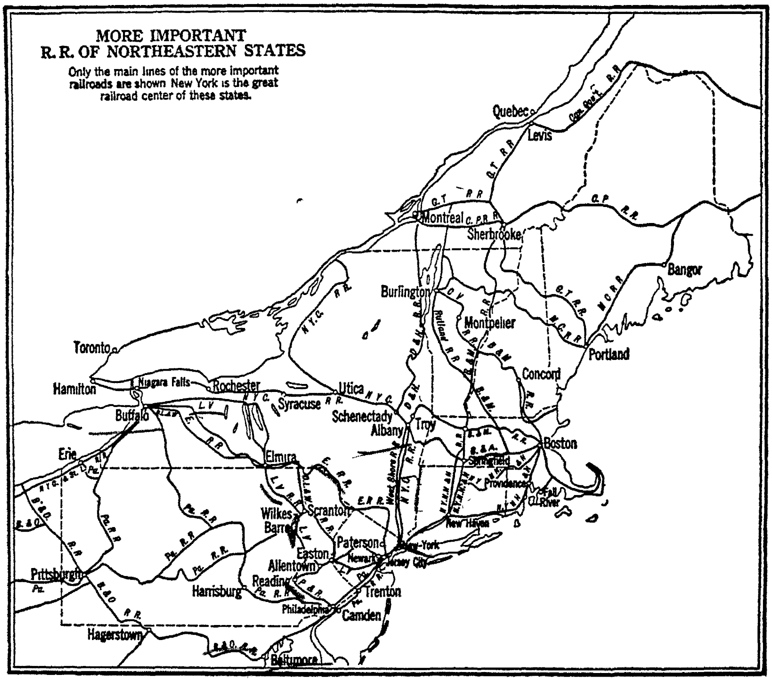

Fig. 54. Most of the more important railroads of these states connect the larger ports with the great northern interior. The greatest rail thoroughfare lies between New York and Philadelphia.

Erie Canal in 1825. The Erie Canal is the only one of the great state canal systems built in the early part of the nineteenth century that survived railroad competition. In 1918 at a cost of more than $110,000,000, the State of New York enlarged this canal, Erie Division, New York State Barge Canal System, to float boats drawing 10-11 feet of water. This gives a water route, 490 miles long, from New York to Buffalo, that has a capacity of 20,000,000 tons a year. The annual movement of freight in 1951 was, however, only 5,211,000 tons.

In railroad building, the third stage in the stampede for interior commerce, New York led also. In fact, one of the first railroads of the country was in eastern New York, near Albany. Before 1842, railroad communication between Albany and Buffalo was established, and shortly after, the Erie Railroad, the first trunkline in America, connected New York with Lake Erie in an almost direct line across the Allegheny Plateau along river valleys. In 1855 New York, because of these successes in laying out traffic lines, had drawn to itself a large part of the traffic of the upper Mississippi Valley and the Lakes region. The route from Buffalo to Albany and down the Hudson to New York was developed for both water and rail and thus dominated as a traffic line. As railways became developed to the west and south from New York, the Hudson-Mohawk route has declined relatively in the traffic between New York and the interior, but the volume remains great. The railroads, however, also gave Boston, Phiadelphia, and Baltimore an opportunity to get a share of the interior trade. There are several well-known railroads that cross the Northern Appalachian region, the Baltimore and Ohio, the Boston and Albany, the New York Central, the Erie, the Lackawanna, the Lehigh Valley, and the Pennsylvania (Fig. 54).

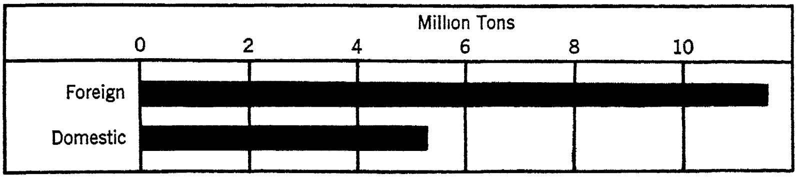

Fig. 55. Comparative tonnage of United States merchant vessels employed in foreign and domestic trade in 1951.

For the reasons indicated above, this group of states may well be called the "bridge states." The eastern approaches to the "bridge" are the New York, Massachusetts, Delaware, and Chesapeake bays which lead to the Atlantic and thus to the world ocean. At the western approach are the Great Lakes, the Ohio River, and the numerous railroads that span the continent. In fact, most of the commerce and trade of the immense area that extends from the Middle Atlantic seaboard nearly to the Pacific crosses the Northern Appalachian region. The factories of this region, therefore, can draw raw materials from a vast area both in America and in the world at large, and manufactured goods have access to a wide market (Figs. 55, 56, and 57).

The Abundant Labor Supply. The great number of workmen available, skilled and unskilled, because of the dense population, is another important factor in the localizing of industries in the Northeastern States. In 1950 the population density of New England as a whole was about 135 to the square mile, and that of the Middle Atlantic states 275; the population densities of the chief manufacturing states were about 225 for Pennsylvania, 285 for New York, 350 for Connecticut, 555 for New Jersey, 548 for Massachusetts, and 675 for Rhode Island. These are high densities for a section as young in its industrial development as is the Northern Appalachian region. Nearly all the better lands have been taken and are being tilled intensively, land values are high, rents are high, "free goods" are scarce, and the factory offers about the only opportunity to feed the thousands who work with their hands. The North Atlantic ports are the chief immigrant-receiving stations of the country. The number of immigrants and alien passengers entering the United States from 1820 to 1950 was about 58,000,000, most of them coming to the Northern Appalachian states. Since most of the immigrants who come seeking work have not the means to begin commercial enterprises or farming, they seek employment in the factories in these cities. The whole foreign-born population of New York City in 1950 numbered over 2,000,000, the total population being 7,835,000; Boston had about 180,000 white foreign-born in the total population of 790,000. Newark had over 90,000 out of a total population of 437,000. Philadelphia, be-

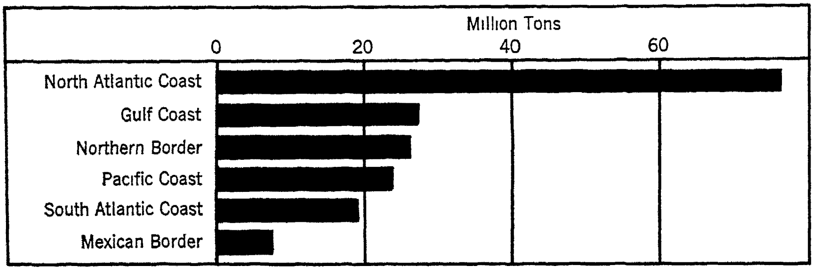

Fig. 56. Foreign trade vessels entered and cleared by customs districts in the United States in 1950.

ing less important as an immigrant port, had over 290,000 in the total of 2,064,000.

There are several other factors of long standing that have contributed, and are contributing, to make this a great manufacturing region. During the colonial period the Appalachian barrier tended to hold the people near the seaboard, thus checking the natural tendency toward expansion, and forced them into more intensive utilization of the resources. The limited area suitable for agricultural expansion in New England, the large area of hilly and mountainous land, and the thin and patchy soil limited the agricultural opportunities and forced men and women into various other economic fields. The fisheries and the merchant marine offered some outlet for the economic activities of the people, but always many were engaged in manufacturing. Manufacturing was also stimulated by the high cost of European goods which had to be carried 3000 or more miles in small and slow ships.

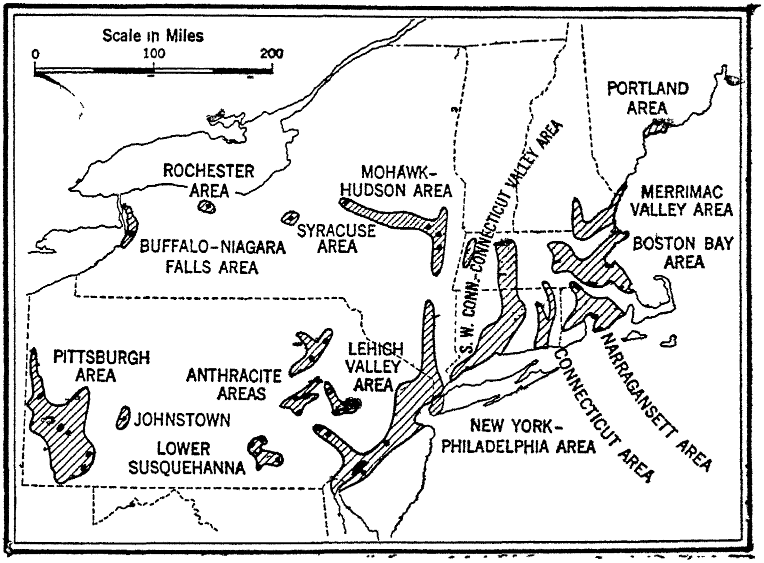

Fig. 57. The more important manufacturing areas in the Northeastern States. Although manufacturing is the dominant activity of the northeastern states, the manufacuring areas form but a small part of the total area of these states.

From early colonial times the manufacturers of the Northeastern States have had ~~skilled~~ craftsmen ~~from~~ whom to select their workmen. In coming to a pioneer environment where civilization by necessity was "stripped of its non-essentials," there was naturally some economic retrogression. There were complaints that many workmen had abandoned their trades for agriculture, yet many of those migrating had been reared for generations in the atmosphere of the workshop of the city and were not so easily attracted to the land as were their descendants in the following generations. But the factories rarely suffered because of scarcity of labor.

In 1650 Boston is reported as having skilled craftsmen in many trades. In Philadelphia there were shoemakers, coopers, wool combers, potters, tanners, felt makers, brick makers, blacksmiths, silversmiths, and many others.

The industries of many parts of the Northeastern States are old enough to have passed into the more advanced stages of manufacturing in which the artistic is emphasized. Quality is recognized as more desirable in manufacture than quantity. The conception of careful workmanship is a tradition carried over from one generation to the next. In an old manufacturing region there is likely to be greater wealth, more refined surroundings, better schools, and more art than in new industrial areas. The Pittsburgh environment, with its huge blast furnaces and its great factories that demand an enormous amount of power, will probably never, in spite of its art museums and beautiful architecture, develop workmen—like those of eastern Pennsylvania, New Jersey, New York, and New England, particularly New England—that take pride in producing articles of beauty. It has taken nearly three centuries to develop the eastern environment in which are manufactured most of the artistic commodities displayed in today's "exclusive" shops.

The Financial Center of the United States. Money with which to start factories has always been easier to obtain in these states than in other sections. The greatest money-lending regions of the world are those in which commerce and manufacturing have long been prominent. The capital of the north Atlantic seaboard cities has financed the enterprises of the whole country. The profits of capitalists and the savings of millions of well-paid workmen have always been available for investment in legitimate manufacturing enterprises in the Northeastern States.

The Leading Manufacturing Regions. Although the great majority of the people of the Northeastern States are connected in one way or another with manufacturing, the industrial regions occupy only a small part of the total area of these states. Moreover, these regions are widely scattered, being chiefly near the sea, along natural lines of transportation, or near sources of power.

The Boston Bay Region and Its Industries. The Boston Bay region is the oldest manufacturing area in the United States and in some ways is the "mother" of other New England regions, since the success of industries in this area led to their establishment in others. Boston has also given financial assistance to many other manufacturing sections outside New England.

The high cost of imported manufactured goods in colonial days, due to the heavy freight rates and enormous profits sought by importers, and the necessity of adding to the meager returns from farming led the people to try their hand at providing themselves with clothing, implements, and other articles that we class as manufactured goods. Industrial development, however, encountered the difficulties usually experienced in new countries. The abundance of cheap land led some good craftsmen to abandon trades they had spent years to learn; yet, through government encouragement, in various ways there was a steady though slow growth in manufacturing. For a century or two these manufactures were almost wholly carried on in the home—household industries—and were small in total volume; yet ideals of good craftsmanship and skill were being developed. The relative abundance of power was also a favorable factor in the early periods; but since about 1850, because of the increase in both number and size of industrial plants, large quantities of coal have been consumed, for the demands for power have exceeded the quantity supplied by water power. In many plants at waterfalls, coal is used to supplement water power during the dry seasons.

The most important industry in the Boston area today is the making of shoes and other leather goods. Boston, Brockton, Lynn, Salem, Weymouth, Beverly, and Worcester are the more important shoe-manufacturing towns. Boston, Brockton, and Weymouth specialize in men's shoes, and Salem, Lynn, and Beverly in women's shoes. The factories of Haverhill on the Merrimack and of Newburyport, which specialize in the making of women's slippers, have close trade relations with the industry in the Boston area.

The shoe industry in Massachusetts is very old. The first skilled shoemakers came to the Massachusetts Bay Colony from England in 1629, and by 1650 the industry was well established. Many farmers made the shoes for their households, and there were itinerant shoemakers who made and repaired shoes; but in most of the large towns, by 1650, shoemakers had set up small shops, popularly known as "ten footers," where shoes were repaired or made to order for people or for stores. Standardization in size, as we have it today, came after a machine which was invented for turning out gun stocks was applied to the making of shoe lasts. Americans have always been among the leaders of the world in devising machines for the shoe industry. In 1809 and 1810 several machines were devised for fastening heels to shoes. It was easy to adapt the sewing machine, patented by Howe in 1846, to the sewing of the "uppers" of shoes, but not for sewing soles to uppers, and a machine for this purpose was devised by Blake in 1858, and later improved by McKay. Machines of this type are still in use in the industry, and shoes made on them are known to the trade as the McKay type. At present nearly 50 per cent of the shoes made in Massachusetts are classed in the trade as the McKay.

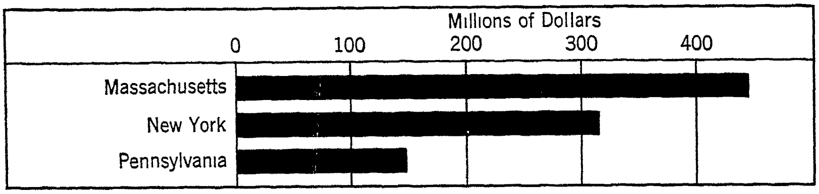

Fig. 58. Leading states in the manufacture of leather footwear and leather cut stock, in terms of the value of the product shipped. This industry is spreading westward and southward, but Massachusetts is likely to hold the leading place for some time. Most of the more expensive shoes come from Massachusetts. One-half of all leather footwear manufactured in the country comes from the Northeastern States.

A welt machine with a curved needle, invented in 1862 by Destary and later improved by Charles Goodyear, has given origin to another type of shoe, known in the trade as the welt or Goodyear. Extreme specialization, great skill, and numerous machines—in some factories a score or more of different machines are used in the making of a shoe—enable American manufacturers to turn out shoes that are in demand the world over. Shoes are manufactured in about a hundred or more towns in Massachusetts, New Hampshire, and Maine. About 25 per cent of the total for the United States, in quantity, are produced in

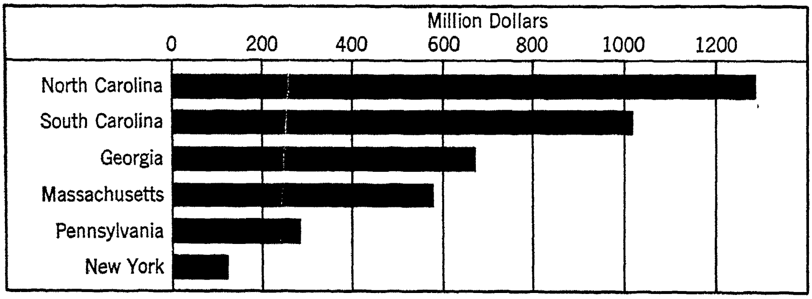

Fig. 59. Leading states in the manufacture of cotton goods, in terms of value shipped. A great advance in this line has been made since about 1900 in the Southern States. The bulk of the product from the South, however, consists of broad woven fabrics and yarns.

Massachusetts alone (Fig. 58). Associated with the making of shoes are a few tanneries and many leather goods factories and plants engaged in the manufacturing of rubber shoes. The manufacturing of India-rubber goods began at Roxbury (now a part of Boston) in 1833, but the industry did not have the greatest growth until the discovery of a method of hardening rubber by sulfur and heat, by Goodyear of Connecticut in 1839.

The textile industry in the Boston area, although not so important as in other parts of the Northeastern States, dates from the colonial period (Fig. 59). In 1656 the Colonial Assembly required each family to spin 3 pounds of woolen yarn each week for 30 weeks each year, under heavy penalty, and in 1640 the magistrates were directed to further the growing of flax, and to provide spinning wheels that the boys and girls might learn to spin wool, flax and cotton. As a result of these efforts, New England by 1700 was exporting manufactured cloth to the southern colonies and elsewhere. The climate of New England was well adapted to the production of wool and favored the growing of flax; and, through the active commerce with the West Indies and India, cotton was supplied the spinners. The first cotton mill in America, it is claimed, was built at Beverly in 1788. Francis Cabot Lowell, after a visit to the textile mills in England, set up the first successful loom at Waltham in 1814. But the Merrimack Valley and the Narragansett Bay region have far outstripped the Boston Bay area in the textile industry.

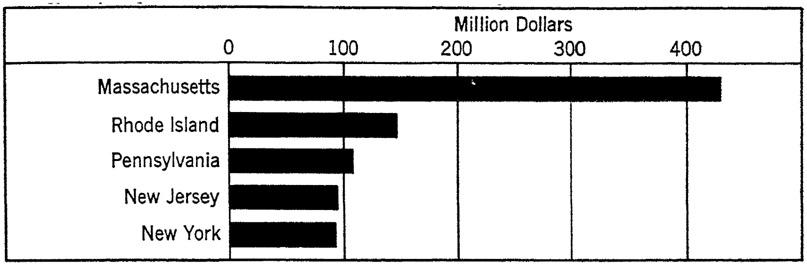

Fig. 60. Leading states in the manufacture of woolens and worsteds in terms of value of product shipped. The dominance of the Northeastern States in this type of textile manufacture is well shown by the graph.

The excellent harbor on which Boston is located, the numerous radiating railroad lines, and the long-time interest in ocean carrying are the chief reasons for the importance of its commerce. Many of the products imported go to the factories of the Boston Bay area and other manufacturing districts of New England. Since World War I, Boston has become one of the most important wool markets of the world, to which buyers come from all parts of the United States and even from Europe. The numerous steamship lines bring wool from all the leading overseas wool-producing countries, and the railroads bring it from the Rocky Mountain states and elsewhere in the United States (Fig. 60). The manufacturers of goods using wool, therefore, find in Boston a great variety from which to select.

The manufacture of chocolate and cocoa products from imported cacao beans is one of the important industries. So also is the preparation of tea, coffee, coconut, and other imported products.

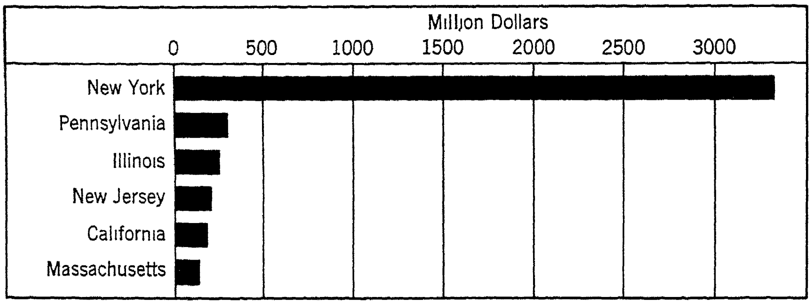

Fig. 61. Leading states in the manufacture of women's and children's ready-to-wear clothing in 1947 (value of product shipped). The dominance of New York State is due largely to great output of jobbers engaging contractors who do not produce in the so-called contract factories. This is made possible by the large labor supply of the New York City metropolitan area. The Midwest and the Far West are increasing in this business.

The making of women's and children's ready-to-wear clothing, which may be considered as the secondary manufacture of textiles, uses large numbers of foreign laborers who work for comparatively low wages. An excellent market for these goods is found in the northeastern section itself (Fig. 61).

The list of minor industries is very large, as one might expect in a region so long engaged in manufacturing. At one time there were iron furnaces at Lynn and Braintree, the one at Lynn having been erected in 1643. Here, for a century or more, agricultural implements and tools, and hardware used in shipbuilding were made. The iron ore came from the glacial ponds and bogs and was smelted by charcoal burned in the nearby forests. There are many foundries and machine shops in which shoemaking and textile machinery is made and repaired, besides the great variety of job work necessary in this machine age. Most of the work in metals is in small metal goods and jewelry, electrical apparatus, and copper and brass. Waltham has one of the largest watch factories in the world, and, it is claimed, turns out about a million watches a year.

The Merrimack Valley ~~Area~~. Textile manufactures, which dominate in the Merrimack Valley area, had their beginning in the city of Lowell. A Waltham, Massachusetts, company purchased a power site at Pawtucket Falls on the Merrimack about 1820, and erected a large cotton mill, about which the village, and later the city, of Lowell grew up. The mill village was a model in its day. Up to 1840 the mill hands, except a few dyers and calico printers who had been secured in England, were American girls from the nearby villages and farms, in whom the company had a much greater interest than it did in the French Canadians who later made up a large portion of the workers, or in the Europeans who came still later. Many other mills were later built in Lowell, and at one time the city was so dominant in cotton manufacturing as to be called the "Spindle City" and the "Manchester of America"; but the water power at Pawtucket Falls became insufficient to meet the needs of the expanding industry. Mills were accordingly built at Lawrence and Haverhill, at Nashua and Manchester and elsewhere in New Hampshire, and at Biddeford and Lewiston in Maine. Lowell has been surpassed by Fall River and New Bedford in cotton manufacturing because the latter two cities, being seaports, can secure cheaper coal than Lowell or any of the Merrimack River cities. It probably is still true that no other river

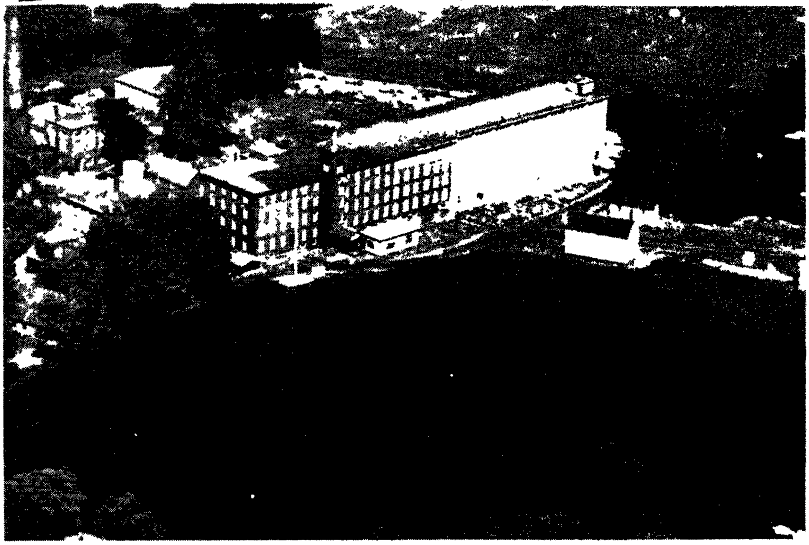

Fig. 62. The Osgood Mill at North Andover, Massachusetts. *Courtesy of M. T. Stevens & Sons Co.* Many mills located by water power still exist in New England. Those at North Andover and Lawrence on the Merrimack River are particularly noteworthy in that they represent the center of the woolen goods industry in the country.

in America supplies power to as many spindles as does the Merrimack. The low cost of building dams, particularly in comparison with those on the Connecticut River, was of particular importance in attracting mills in the early decades of the nineteenth century (Fig. 62).

Haverhill and Newburyport, as previously stated, are interested in the manufacture of shoes, and the shoe industry also dominates at Manchester, New Hampshire. But woolens and worsted goods are by far the leading products of the factories at Lawrence. This city produces about an eighth of the wool manufactured in the United States, in value, and a third of the total for Massachusetts. Most of the small cities of southern New Hampshire and southwestern Maine manufacture shoes and woolen and worsted goods, and not a few still have an interest in woodworking, being the nearest of the New England cities to the forests in the north.

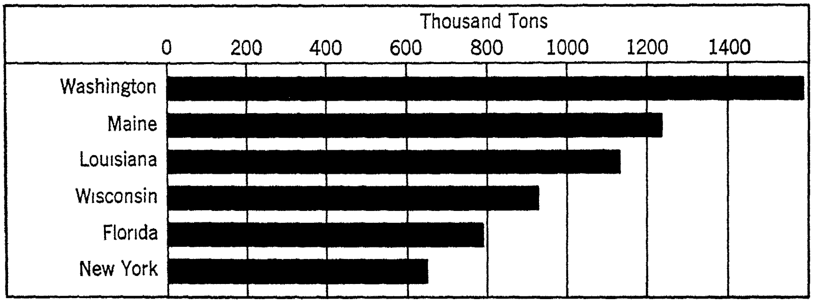

Fig. 63. Leading states in woodpulp production. Western and Southern as well as the Lake States are important in this industry, yet the combined Northeastern States are still important producers. It was only after 1940 that Maine lost leadership to the State of Washington.

Pulp mills are widely scattered in northern New England, being located at falls on the rivers, which, because of the many glacial lakes in their basins, furnish clean water and have a fairly regular flow (Fig. 63).

The wide range of metal manufactures is seen in the making of locomotives at Manchester, needles in some towns, and silverware at Newburyport. Foundries and machines shops, as in the Boston Bay area, are numerous. At Portland, Maine, there are many foundries and machine shops, some textile mills and shoe factories, and plants for canning and preserving vegetables and fruits.

The Narragansett Bay Region. Although the manufactures of the Narragansett Bay area are varied, the textile industries predominate. At Pawtucket, on the Blackstone River, Samuel Slater built his first cotton mill of 250 spindles in 1793. During the latter half of the eighteenth century there had been many epoch-making inventions in textile manufacture in England, by Kay, Hargreaves, Arkwright, Compton, Cartwright, and others, but Parliament had prohibited the exportation of any of the machines or even the drawings of them. Samuel Slater, who had worked several years in textile-machine factories and had made himself familiar with the parts and operation of the Arkwright spinning machines, migrated to America and, with the help of Rhode Island capital, built the first modern cotton mill in America. About all that Rhode Island offered as an inducement to the industry was capital and a limited amount of water power. Wool was obtained from Rhode Island or Massachusetts flocks. Cotton, for a few years after the completion of the Pawtucket mill, was brought from India or the West Indies, Providence being the port of entry. Success from the first met this new venture, and the textile industry soon began to draw much of Rhode Island capital into it. From Pawtucket the textile industry spread up the Blackstone, every waterfall or rapids becoming the site of a textile town, even on into southern Massachusetts. Pawtucket, Central Falls, and Woonsocket today are the larger textile centers. The valley of the Pawtuxet River, to the southwest of Providence, also has many textile towns, and the industry has expanded on into eastern Connecticut along the Quinebaug and other branches of the Thames. The chief cities in the latter valley are New London, Norwich, and Willimantic, Connecticut, and Webster, and Southbridge, Massachusetts.

In this expansion along streams, state lines were no barriers to the textile manufacturers in their zeal to find power sites. The limited amount of water power at many falls or rapids has somewhat retarded factory growth in comparison with that at ocean ports like New Bedford and Fall River which receive western Pennsylvania coal from the Delaware and Chesapeake Bay shipping points. All the early mills were erected at power sites on the river, the later ones near the sea. Power, therefore, has been an important factor in localization, although the shore climate has had some attractions. There is a surprising concentration of spindles in southern Massachusetts. Bristol County, which contains the three large textile cities of New Bedford, Fall River, and Taunton, has about 7,500,000 spindles, or more than one-fifth of the total for the United States.

The Narrangansett Bay region manufactures both cotton and wool goods (woolens and worsted). New Bedford, Fall River, and Pawtucket are predominantly cotton towns. Providence produces some wool goods, as do also many of the towns in the Quinebaug Valley. Pawtucket's interests are largely in cotton and silk, but Woonsocket, although producing these goods, is most active in the manufacturing of woolens and worsteds. The manufacture of goods from wool dates from colonial days, and many mills have developed from early carding and fulling mills; but the worsted industry in America dates from the 1860's when a tariff on imported worsteds was passed by Congress and skilled workmen from Europe were brought to America. The manufacture of worsted calls for large plants and costly machinery. The industry is widely scattered in the Northeastern States; besides the cities already mentioned—Lawrence, Manchester, and Woonsocket—woolen mills are found at Fitchburg, Worcester, and many smaller places.

Most of the textile mills of the Narragansett Bay area are complete in themselves and perform all the processes from raw products to finished goods, but there are plants given over exclusively to spinning, weaving, bleaching, dyeing, or finishing. Associated with this great activity in textile manufactures are foundries and machine shops.

The manufacture of jewelry ranks next to that of woolens and worsteds at Providence, in value of product and value added by manufacture. Like many of the industries of the Northeastern States, and particularly of New England, this industry is an old one, dating from about 1780. "Gold filling" was invented by Dodge of Providence in 1794, and the manufacture of silverware was begun soon after the Revolutionary War. Skill in workmanship and a reputation for good wares have kept Providence in the lead in jewelry manufacture.

Diversified Industries of the Connecticut Areas. Since late colonial days Connecticut has been producing clocks, watches, tinware, small metal goods, and "Yankee notions." When transportation was still in its primitive stages in America, peddlers with push carts visited the farmers along the waysides of Connecticut and other nearby states and supplied them with much-needed household articles. In the early part of the nineteenth century, Connecticut clocks and other articles were sold in the farming communities and small villages and cities of the Northeastern States and even the Middle West and the South. Today something like 1200 articles are manufactured in Connecticut.

The textile mills are widely scattered in Connecticut and in the Connecticut Valley in Massachusetts. The manufacture of silk began in 1732. Mansfield had a factory in 1758. Cheney Brothers began the manufacture of spun silk at South Manchester in the 1840's. Today South Manchester in Connecticut and Northampton in Massachusetts are the leading centers. The dominant reasons for the localization of silk factories in these towns are early interest in the making of textiles, the presence of skilled textile workers, clean water, and water power. The activity of New England in the carrying trade with India and the Far East in the colonial period made the securing of raw silk at low prices possible.

There was a small woolen factory at Hartford in 1788; today, mills are found at Hartford, Norwich, Rockville, and many small towns on streams that furnish water power. Danbury, in western Connecticut, is interested in the making of hats and caps and the machinery for manfacturing these articles. The mills at Pittsfield in western Massachusetts began when sheep were numerous on the Berkshire Hills. The large amount of water power available at Hadley Falls at Holyoke, where the Connecticul falls 60 feet in 1½ miles as it descends from the crystalline uplands to a broad valley, gives the city a decided advantage in the making of pulp and paper. It was not until about 1849 that the engineers felt competent to harness a large falls. A dam 1017 feet long was constructed that year, and a large amount of water power, 40,000 hp in all, was developed along the numerous canals that led away from the river above the falls. Cotton goods were the first manufactured products of Holyoke, many small power sites being utilized; but today Holyoke leads all cities of the United States in the manufacture of fine paper. Holyoke, with its large plants equipped with large pulp grinders and Fourdrinier paper machines, was soon able to outstrip the numerous smaller plants at small water-power sites on the slopes of the Berkshires. At one time the Housatonic River Valley in Massachusetts had more than a score of plants; one town, Lee, had 18; but the smaller

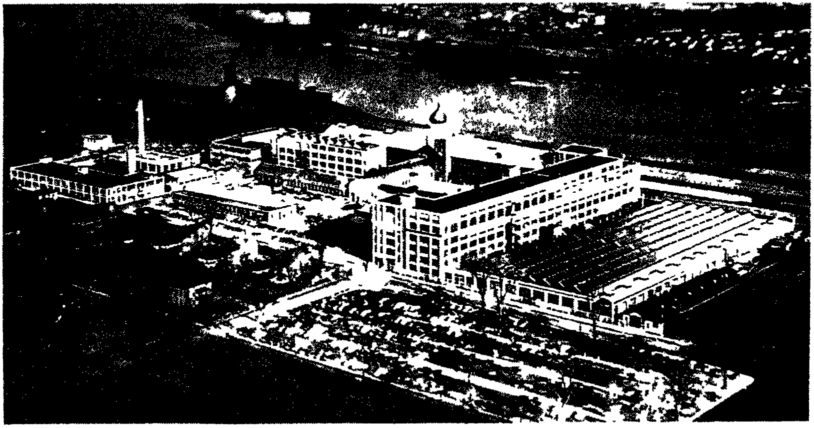

Fig. 64. Plant of the Colt's Manufacturing Company at Hartford, Connecticut. *Courtesy, Colt's Manufacturing Company.* This plant has been producing firearms for more than a century. Here the Browning machine gun and automatic rifle were invented and manufactured. Here also Vicker's machine guns and automatic pistols and revolvers were produced for use in World War I. The plant has also turned out washing machines, tableware, electrical goods, radio parts, and various articles made of Bakelite and phenolic compounds.

plants have not succeeded in competition with the larger, and now there are fewer pulp and paper mills than formerly but a greater output.

The southwest Connecticut and Connecticut Valley region, however, is most active in the manufacture of firearms, brass and bronze, clocks and watches, plated ware, cutlery, and metal "specialties" of various sorts, as earlier stated. At New Haven, Bridgeport, Hartford, and New Britain in Connecticut, and Springfield in Massachusetts, foundries and machine shops are the leading plants, and metal goods are manufactured at many other industrial centers (Fig. 64).

Rogers Brothers began the making of cutlery in 1847 at Meriden, and this led to the establishment of "plating" plants at Waterbury, Norwich, and Hartford. The making of brass buttons at Waterbury led to the plants turning out brass, bronze, and copper products, which industry is very active in the Naugatuck Valley today. Hartford at one time was one of the leading cities of the country in the manufacture of bicycles. It now manufactures automobile bodies and accessories. Firearms led the foundries and machine-shop products of Springfield; and firearms and sewing machines those of Bridgeport. The manufacture of firearms at Springfield dates from the Revolutionary War period, an arsenal having been established here by the Continental Congress. Springfield small arms have long been famous.

There seems to be no outstanding geographic reason for the prominence of small metal goods in the industries of this region. Before the Revolutionary War, the manufacture of pig iron and iron goods was active, the ore being obtained from deposits in northwestern Connecticut. The lack of coal for fuel and power has forced New England in general to an intensification of manufactures in the competition with western Pennsylvania. Many important inventions have been made in this region and these have contributed greatly to the interest in manufacturing. Connecticut clock makers have long been noted for their ingenuity. Eli Terry was a famous maker of wooden clocks; Jerome in 1837 conceived the idea of using brass wheels; and at Thomaston for many decades the famous Seth Thomas clocks have been manufactured. It was in this region that Howe and Wilson devised the sewing machine, and here Charles Goodyear, after many years of thought and experimentation, perfected the process of vulcanizing rubber, and Colt began the manufacture of Colt firearms. Eli Whitney, whose cotton gin made cotton the leading textile fiber of the world, was a Connecticut Yankee. From no other region in the United States have inventers taken out so many patents. Thus, all along, the boys of this region have had schooling in ingenuity. Many fortunes have been made by perfecting some article in great demand, and this in itself has been inducement enough for men to become inventors and manufacturers of the articles devised.

Still another factor, non-geographic, that was of great importance was the Joint Stock Act, adopted by the Connecticut Legislature in 1837, whereby men with small capital were permitted to pool their holdings and thus join forces in manufacturing. This act has since been adopted by all the states of the United States, by Great Britain, and by most other manufacturing countries.

The Connecticut region has always had good transportation facilities, as good as any in America, a good supply of labor, and much capital. Its metal manufactures call for little raw material and little coal, but much skill.

The Mohawk-Hudson Area. The industrial area along the Mohawk owes its development to several factors. Shortly after the valley was settled, small mills for sawing lumber, grinding grain, and pressing flax seed were set up along the numerous small streams that flow down the slopes of the bordering uplands; but these, after engineers had gained experience in building large dams, were overshadowed by the large developments at Little Falls, Cohoes, and elsewhere. And when manufactures outgrew the available water power, railroads began to bring coal to the factories from both the anthracite and the bituminous regions of Pennsylvania. Since the opening of the Erie Canal in 1825 the cities have had the best of transportation facilities to collect raw materials and get their products to buyers. The earliest railroads of New York were constructed westward from Albany. Although the Barge Canal, with its 12 feet of water and locks 310 feet long and 45 feet wide, and its annual capacity of 20,000,000 tons, is far from being used to its capacity, it forces the railroads to give minimum rates to the factories.

Troy is famous for its shirts and collars; and Cohoes, near the mouth of the Mohawk, is the greatest center in the United States for the manufacture of knit goods. Schenectady has large locomotive works and is the home of the General Electric Company, one of the largest manufacturers of dynamos, motors, and electrical appliances in America. Among the other industries at Schenectady are those producing hosiery and knit goods, hardware, paints and varnishes, fire engines, and agricultural implements. Carpets and knit goods are made at Amsterdam, and cotton and woolens at Utica and Johnstown, and Gloversville manufactures most of the gloves worn in the United States. Rome, on the divide between the Hudson River and Lake Ontario, produces brass and iron goods.

The Industries of Syracuse. Syracuse, farther west on the border of the Lake Plains, ranks high among the manufacturing cities of the state.

Many of the factories are supplied with hydroelectric power from Niagara Falls. The principal products of its factories are automobiles, foundry and machine shop products, ready-made clothing, iron and steel products, typewriters, sewing machines, shoes, and agricultural implements.

The Syracuse region early became known to Europeans because of the salt deposits. Long before the Revolutionary War, the Indians evaporated brine and sold salt to the whites at Albany. In 1795 the state purchased the salt lands of Onondaga County from the Indians and encouraged the production of this most necessary article. Onondaga salt had a wide market until the opening of great deposits in Michigan. The salt deposits since about 1920 have become the basis of a large chemical industry, the largest plant in America for the production of soda-ash being at Solvay, a suburb of Syracuse. The method of manufacture is called the Solvay process.

The Industries of Rochester. Flour milling was the first industry at Rochester, the abundant water power of the Genesee—there are three cataracts with 96-, 36-, and 83-foot drops, respectively—being used to furnish the energy. After 1825 the Erie Canal gave ready acess to eastern markets. Flour milling is still active, but the city's largest industry today is the making of men's clothing which finds a market over most of the United States. The making of shoes and leather goods holds second rank, and foundry and machine shop products third. Rochester is widely known as the "Kodak" city. In the manufacture of photographic apparatus and supplies, moving picture supplies, meteorological apparatus, and optical goods such as telescopes, opera and field glasses, it probably holds first rank among the cities of the world. It also manufactures much electrical apparatus and machinery.

The Buffalo-Niagara Falls Area. The industries of Buffalo, in the Buffalo-Niagara Falls area, owe their development largely to their being at the eastern terminus of the Great Lakes, near the coal, oil, and gas fields of western Pennsylvania, and to their having excellent transportation facilities to the eastern markets by way of the Erie (in past) and Barge canals and the numerous railroads.

Commerce is one of the chief activities of Buffalo, this city being a distributing center for the manufactures of the East seeking western markets, and for the products of the forest, field, and mine on their way to the East. This close touch with producing regions and markets gives the industries of Buffalo a decided advantage. Its chief plants are flour- and gristmills, linseed-oil plants, slaughtering and meat-packing plants, mills turning out lumber and timber products, shops making cars and railroad equipment and repairs, and laboratories making patent medicines, chemicals, and soaps. There are also copper smelters and refineries, petroleum refineries, drydocks and shipyards, and a large steel plant of the Lackawanna Iron and Steel Company.

Tonawanda, to the north, the eastern terminus of lake navigation, is an important lumber center; and at Niagara Falls there has grown up, since the construction of several hydroelectric plants, an important electrochemical industry. Chemicals are the chief manufactured products of the city of Niagara Falls. At many of the smaller towns in northwestern New York and at some of the larger cities—mainly outside the Buffalo-Niagara Falls area—there are large plants for canning and preserving fruits, making wine, and bottling grape juice, the raw materials coming from the nearby fruit region.

The Varied Industries of the New York-Philadelphia Area. The area that lies between New York City and Philadelphia, inclusive, is the most important manufacturing section in the United States, judged from the value of the output of the factories and the value added by manufacture. More than one-sixth of the manufactured products of the country, in value, comes from this area. It is not a region producing large quantities or a variety of raw products. There is little or no water power, no coal, oil, or gas. Its chief asset is its location near the center of the habitable coast of North America on the western border of the most important commercial ocean, the Atlantic, at the eastern termini of the best traffic routes across the Appalachian Highlands, and near large deposits of excellent coal. The output of its factories is varied. Indeed, it would be difficult to think of many articles not manufactured in this region.

The Importance of the New York City Area. Chief among the manufacturing cities of this area is New York. Although commerce is one of the major activities of the city of New York, the output of the factories in 1947 amounted to $5,501,000,000.[1] This was about 57 per cent of the total of the State of New York, and 7 per cent of the output of the factories of the United States. The output of the factories of New York City in 1947 was greater than that of all the factories of the United States in 1880. The Erie Canal and later the railroads gave access to the interior of the United States, the large number of immigrants who landed at the port of New York, and the expansion of overseas commerce that have made New York City, since the middle of the nineteenth century, the largest manufacturing center of the United States.

The most important industry is the making of men's and women's clothing, representing more than a quarter of the total output of the factories of the city in value, or in value added by manufacture. This industry is carried on largely in small shops, and its importance is due largely to the abundant supply of foreign labor and the large market. Other related products are millinery and lace goods, fur goods, men's shirts, silk goods, and men's furnishings.

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[1] The foreign commerce of the port of New York, which includes parts of New Jersey and New York State, in 1947 was 16,700,000 tons, or nearly 30 per cent of the total for the United States.

In the printing and publishing of newspapers, magazines, and books, New York leads the cities of the country. Among other industries and plants are slaughtering and meat packing, bakeries, confectionery and ice cream plants, and foundries and machine shops.

The Industries of Northern New Jersey. The cities of northeastern New Jersey, on or near the Hudson River and the bays—Upper New York, Newark, and Raritan—are really a part of geographic New York, and their growth is due to many, if not most, of the same causes. Farther south, toward Philadelphia, the cities share many of the advantages for growth that have made Philadelphia the third manufacturing center of the United States in value of product. The narrow strip of territory between the Hudson and the Delaware in New Jersey has about four-fifths of the people of that state and nearly all the manufactures.

In value of product the five leading types of manufactures in this area are refining the copper and oil, building ships, making of silk goods, and slaughtering and meat packing; but, based on value added by manufacture, the list of products in order of importance is ships, silk goods, refined oil, rubber tires, rubber goods, and leather.

There are large shipyards at Elizabeth, Bayonne, Jersey City, and Camden, at which both wooden and steel ships are constructed. Paterson, the "Lyons of American," owes its prominence chiefly to the success of early attempts at the manufacture of silk cloth and floss, which was first begun here about 1840. Coal fields are near, and also excellent markets, but the raw silk was imported from the Far East or Mediterranean regions. Until about 1940 there were about 800 plants in New Jersey interested in all phases of the manufacture of silk and rayon including dyeing and finishing. The outbreak of war in Europe in 1939 and later with Japan handicapped this industry because it stopped the cheap source of raw silk. Rayon manufacture continues, but it tends to shift to the southern states in proximity to the raw resource, cotton. Elizabeth and Bayonne have immense petroleum-refining plants, which at Elizabeth cover more than 800 acres, with distilleries and refineries, laboratories, tanks, and warehouses, at which crude oil from all the fields of the United States east of the Rocky Mountains, even from Oklahoma and northern Texas, is separated into scores of products for home consumption or export. Bayonne has immense docks for receiving crude petroleum from foreign fields or loading the tank vessels with export product. The advantages for overseas shipping and the proximity to large domestic markets are undoubtedly the chief geographic reasons for the localizing of oil refining on the shores of New York Bay and connecting waters. Not a drop of crude oil is produced in New Jersey.

Advantages in the importation of crude rubber from Brazil and from the very important sources of supply in the East Indies, the large local markets, access to large, more distant markets, and activity in the chemical industry are all favorable to the production of rubber tires and rubber goods.

The tanning industry at Newark dates from about 1770, when hides derived from local slaughtering houses were tanned with oak and hemlock bark from New Jersey forests. Now hides may be imported readily or secured from the slaughtering houses of New Jersey or New York or Chicago; but the tanbark must come largely from the distant forests of the Appalachian Highlands or be imported. Much tanning extract is now used.

The refining and smelting of copper, which stands first among the industries, when value of product is considered, is carried on chiefly at Camden and Newark. It probably had its beginning in the treatment of the copper ores mined in the Piedmont in the state; but the refineries and smelters today treat large quantities of ore from the western states as well as from Mexico, Bolivia, Peru, Chile, and elsewhere. Pennsylvania furnishes the fuel. The state still produces small quantities of copper ore; and zinc, once very important in its output, is now mined, although in small quantities, at Franklin Furnace. Platinum, nickel, gold, silver, zinc, and lead are also treated in New Jersey metallurgical works, the more important of which are at Elizabeth. The manufacture of iron began in 1674, with ores mined near Shrewsbury. The interest in this industry is attested by the fact that one of the inventors, at Newark, devised a machine for making nails, made several improvements for locomotives, and discovered a method of making malleable iron. Magnetite is still mined in small quanities, and several cities have iron and steel works.

The above types of industries are only a few of the more important. Numerous foundries and machine shops, as well as textile factories, are to be found in all the cities. Camden manufactures cotton and worsted goods; Passaic, woolens and worsteds; New Brunswick, hosiery. The Singer Sewing Machine plant at Elizabeth is one of the largest, if not the largest, in the world. Felt hats have long been made at Newark, and Orange and Jersey City refine both cane and beet sugar, and raw sugar coming mostly from Europe and the West Indies. The clay deposits near Trenton gave an early impetus to the pottery industry, although ball and flint clays and kaolin are now imported from other states or from overseas. Many brick plants in northeastern New Jersey find a good market in New York City and other urban centers. Pennsylvania coal supplies the great heat necessary in the manufacture of pottery at Trenton, brick in many cities, and glass at Glassboro and Millville, which are on the Coastal Plain in southern New Jersey near large deposits of sand suitable for the making of glass.

Philadelphia and Vicinity. Philadelphia has a slight advantage in manufacturing over New York in having easier access to both anthracite and bituminous coal fields. The first canals and canalized rivers constructed in Pennsylvania connected Philadelphia with the Schuylkill and Lehigh coal fields. The Lehigh River was improved about 1822, and soon after "arks" loaded with coal floated down to the state's metropolis by way of the Delaware. Franklin, as early as 1770, advised the construction of a canal along the Schuylkill, but nothing was done toward utilizing this water route until 1822 when $1,000,000, a tremendous sum for that day, was appropriated, and coal began to move downstream in 1825. The Pennsylvania Canal, which was completed in 1830 and in operation only about two decades, and the Pennsylvania Railroad, constructed in the 1850's, put Philadelphia in touch with the bituminous fields of western Pennsylvania. Philadelphia is also an ocean port, but its contact with the great North Atlantic trade route is not so close as that of New York, nor does it have so low a land route across the Appalachian Highlands. It was chiefly this better route across the Highlands that enabled New York to forge ahead of Philadelphia in the last century or more in population growth, and eventually in growth of manufactures.

As in Boston, Providence, and some cities of Connecticut, many of the present-day industries of Philadelphia and the nearby towns had their start in colonial days. The manufacture of hosiery and knit goods was begun by German colonists shortly after 1680, hand looms being used. "Germantown woolens" were well known throughout the Middle Atlantic settlements. The first active manufacture of iron in the state was at Pottstown, some 30 miles from Philadelphia in the Schuylkill Valley, probably as early as 1716. The woolen industry of the city was greatly aided during the Revolutionary War by the large orders given for uniforms for the Continental Army. Carpet weaving was begun in 1774.

In value of product, sugar refining is an important industry in Philadelphia. This city, like all Atlantic ports, possesses good facilities for the importation of raw sugar, and can command a large domestic market. In value added by manufacture, this industry ranks very low.

The weaving of woolen goods, carpets and rugs, and cotton goods and silks, and the making of men's and women's clothing all rank high among the industries and owe their importance to their long standing among the industries of the city and to the good transportation facilities for collecting raw materials and distributing the manufactured articles. Cramp's shipyard and the Federal Government yard at League Island, at which many of the vessels for the United States Navy are built and equipped, are famous. Philadelphia's yards launched many of the finest of the clipper ships in the decades when these swift vessels made America famous on the world's oceans. The Baldwin locomotive works have for decades been producing the best of American locomotives. (Fig. 65). Their superiority over foreign makes is indicated by the large orders from all parts of the world where railroads are opening up undeveloped regions to world commerce. Thus Philadelphia makes its contribution to both sea and land transportation. Stetson hats, Disston and Keystone saws, the Saturday Evening Post, and Philadelphia tools typify other leading industries.

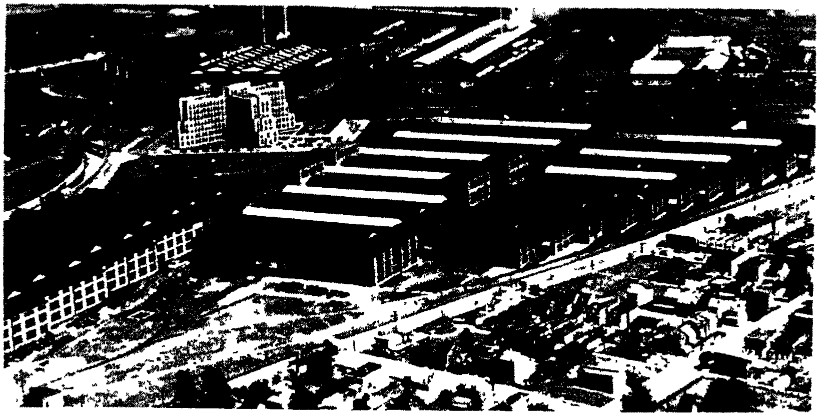

Fig. 65. Airplane view of the 488-acre plant of the Baldwin locomotive works at Eddystone, Pennsylvania, near the city of Philadelphia. *Courtesy, Baldwin Locomotive Company.*

The leather industry is very old but received its greatest growth about the time of the Civil War, when the decline of the forests of New York made an imperative call for another source of tanbark, and Pennsylvania ridges with their dense oak forests were able to supply the demand. By 1880 Pennsylvania had one-fifth of the tanneries of the United States. Although the Northern Appalachian forests have long since been depleted of their tanning materials, the use of tanning extracts and a monopoly of a chemical tanning formula have enabled Pennsylvania to hold its lead among the states. Philadelphia is the leading city.

Chester, to the southwest of Philadelphia on the Delaware, has rolling mills and steel works and shipbuilding, and has long been interested in the textile industry, the making of cotton and worsted goods and artificial silk.

The valley of the Schuylkill, when coal was the chief fuel used in iron making in Pennsylvania, was before about 1870 the seat of an active iron industry.

Industrial Symbiosis in Eastern Pennsylvania. There are plants in eastern Pennsylvania making iron and steel castings, builders' hardware, iron pipes, and textile-mill machinery. These call for male laborers, whereas the numerous factories employed in producing knit goods or in dyeing and finishing textiles give work to the more delicate hands of women. Most of the workers, male and female, are foreigners. This "symbiosis" in industrial types is repeated in nearly every one of the cities in or near the anthracite regions of the state. Scranton, in the Lackawanna Valley in the Wyoming field, is interested in producing locomotives, mining machinery, and many other iron and steel products, and also woolens, cottons, laces, and buttons. Wilkes-Barre, also in the Wyoming field, has machine shops, forged axle and wire rope works, and also silk and lace mills. Allentown in the Lehigh Valley, which leads out of the Lehigh coal fields, has iron furnaces, rolling mills, foundries, shoe factories, and cement plants, and also silk and knitting mills. Bethlehem has the great Bethlehem steel works which produce armor plate, steel rails, machinery, and castings of many sorts. In the city and nearby towns there are cement plants, brick yards, and automobile works, as well as silk mills and ribbon factories. Easton, also in the Lehigh Valley at its junction with the Delaware, produces cement, pig iron and steel, pneumatic tools, mining and hydraulic machinery, chemicals and paints, and also silk goods, cotton yarn, and hosiery. Hazleton manufactures mining machinery, pumping machinery, pianos, and other products demanding the labor of men; and also silk, hosiery, knit goods, overalls, and other goods which may be made by women and children. At Norristown, Harrisburg, Steelton, and other cities, the same conditions as to labor demands exist.

Smaller Industrial Centers in Pennsylvania. The industries of Lancaster and York bear a closer resemblance to those of New England than to the industries of the cities just discussed. Lancaster has a watch factory, a linoleum plant, a toy factory, and plants producing small metal goods, such as jeweler's tools, padlocks, and ball bearings. The textile products are cotton and silk. York makes agricultural implements, tobacco and cigarettes, paper products, a wall finish of excellent quality, leather goods and textiles, as well as a few heavy articles, such as ice-making machinery, sawmill equipment, chain and wire.

Altoona, at the eastern foot of the Allegheny Front near a low gap in this mountain wall, is a small industrial center standing quite alone in a large area of agricultural and forest lands. It is largely the creation of the Pennsylvania Railroad, which has here its largest shops. It is near the eastern edge of the bituminous coal area. Other industries are silk mills, and iron works and brick yards the localization of which is due to nearby deposits of clay, as well as fuel.

Iron and Steel in the Pittsburgh Area. The industrial region of western Pennsylvania is dominated by Pittsburgh, the "Iron City"; and the industries of most of the cities of the area are but reflections of those of the major city. The abundance of fuel—coal, oil, natural gas—with a few raw materials such as glass sand and iron ore, or easy access to iron ore, have from the first been factors favoring the localization of the iron and steel industry. The position of Pittsburgh, at the junction of the Monongahela and Allegheny rivers and at the head of the Ohio, enables it to collect raw materials by water from the north and south, the rivers having been improved for some distance from Pittsburgh—91.5 miles on the Monongahela. In the settling of the Ohio Valley, Pittsburgh was the port of embarkation for the flatboat journey down the Ohio, and afterwards the farmers looked to the city to fill their needs for manufactured goods. Until the completion of the Pennsylvania Canal and Portage Railroad and, later, the Pennsylvania Railroad, transportation across the Highlands was so expensive that Pittsburgh or the surrounding region was called upon to produce most of the manufactured goods used in the Ohio Valley. An iron furnace was erected near Uniontown about 1790, using local iron ore and charcoal. Hollow ware and other articles needed on the frontier were made. By 1806 the manufacture of iron was well begun. The first rolling mills were built in 1812. Iron came to dominate the industrial life of the city after about 1825. The greatest development followed the use of Connellsville coke and, later, the use of the rich ores of the Lake Superior region. It has been found that coal other than that at Connellsville will make coke suitable for iron smelting, and that the southern Lake ports are as well located for the meeting of iron ore and fuel as the forks of the Ohio; yet the large amount of money invested in blast furnaces and steel mills that would have to be sacrificed if plants were moved enables Pittsburgh to hold its place as the greatest iron-producing city in America. From the industrial nucleus at the forks of the Ohio, city after city has grown up along the Allegheny and Monongahela, along the Ohio, and even along Beaver River northward toward Lake Erie. Johnstown on the Conemaugh, to the east of Pittsburgh, has a coal, iron, and steel industry. Most of the ore comes from Lake Superior.

About one-third of the factories of the city of Pittsburgh are engaged in producing iron and steel and products of steel works and rolling mills; the total value of the products of blast furnaces, steel plants, foundries, and machine shops is one-half the total for the city. Nearly all the iron products of the Pittsburgh area are "heavy" iron and steel goods, in which the amount of material, rather than the amount of skill or labor, largely determines the value. The Westinghouse air brakes have been furnished by Pittsburgh to a large part of the railroad cars of America, and Westinghouse electrical apparatus is well known. Some work is done in brass, bronze, and copper. The making of glass dates from 1797, the industry being first localized here because of the abundance of glass sand; its later expansion was due to the large stores of natural gas, which is both a cheap and an ideal fuel in glass making. The city being a railroad center, there is a call for locomotives, cars, and general railroad repairs.

Trends and the Future of Manufacturing in the Northeastern States. From the beginning of American history, trade has been of primary importance in manufacturing in the Northeastern States, and freight costs, today, remain an important factor in the lives of the people. At an early date, fishing stimulated sea trade, which in turn supported industry. As the West developed its lands and resources the Northeastern States developed its industries not only to supply the West but also to enter worldwide markets. With the impetus of an early start, cities grew and population density became great; hence to a large extent the people of this section today live by selling manufactured products made of imported raw materials.

Since about 1910 some of the industries of the Northeastern States have shown a tendency to shift to other sections of the country. The cotton-textile industry as well as silk and rayon manufacturing have advanced in the southern seaboard states and declined in the northeast. The steel industry, the boot and shoe industry, and others have tended to move westward. This does not mean that manufacturing has ceased or even that it may in the future come to an end in the Northeastern States, for this section remains the great manufacturing center of the nation. Some abandoned industrial plants are in evidence and some cities have been hard hit by a decrease in population. However, with new products and improved processes, some of the old textile centers have partially adapted themselves to the change, but the question arises, "Can the Northeastern States retain sufficient industrial activities so as to increase in numbers and prosperity and maintain a standard of living in accord with the future increases in the remainder of the nation?" To arrive at an understanding of the problem it is necessary that one examine the events, and conditions which apply to them.

The causes for this shift in industry are numerous, but important among them are: (1) longer hours, lower wages, and no labor troubles among the workers, mainly in the South, (2) lower land values, taxes, and rents elsewhere, (3) improved markets in the South and West resulting from growth in population, and (4) nearness to sources of bulky raw materials. On close examination it is noted that some of these causes are not necessarily lasting ones. As industrial plants move to new sections, land values rise, also taxes and rents. Labor unions follow the workers, and in general there is a tendency to standardize wages, hours, land values, rents, and taxes throughout the land. Thus from the causes mentioned it would seem the shifting of industries would come to an end eventually.

Another factor of importance is that skilled labor and management tend to remain in the original centers. Thus those manufactured products that require skilled labor and have high value compared to their weights, so as to stand higher freight rates, become a specialty in the northeastern states. The cotton-textile industry illustrates this point in that the product of the southern mills consists of a large volume of common woven goods and outing flannels, whereas that of the northeastern mills includes laces, print-cloth and the more highly technical fabrications.

Perhaps the most important change in industries of the Northeastern States is the development of the steel industry since 1940 in the embayed section along the Atlantic seaboard, as at Morrisville, Pennsylvania, on the Delaware River above Trenton, as well as that farther south at Sparrows Point, Maryland, on Chesapeake Bay. The growing importance of importation of special quality ores from Labrador, Quebec, Venezuela, Cuba, Mexico, and a few other sources favor these locations because the land haul of this bulky commodity to inland steel centers is thus eliminated.

The future of northeastern manufacturing cannot be predicted with any degree of certainty because of the many factors involved, but some geographic conditions are favorable for its maintenance and are thus worthy of consideration. The efficiency of labor is stimulated by a climate in the Northeastern States not generally equaled in other sections of the country.[2] The proximity to superpower development anticipated from the mighty St. Lawrence is favorable. Also the front-door position of the Northeastern States on the North Atlantic trade route gives the section an advantage in general shipping rates from and to important foreign lands. Finally, the dense population of a highly developed people in this section is in itself a large market for manufactured products. Transportation facilities and freight rates will continue to be an important factor since a large part of the raw materials of industry must be imported.

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[2] Ellsworth Huntington, *Civilization and Climate*, Yale University Press, 1915.

QUESTIONS, EXERCISES, AND PROBLEMS

1. Is it environment or man that has made the northeastern states the greatest manufacturing region in the United States? What are the natural environmental conditions? Did the Europeans who settled this section bring with them European inheritances and experiences that contributed to the great industrial development?

2. Is it environment or man that keeps New England a manufacturing section?

3. Make a list of 25 of the largest cities of the United States. What percentage of the total number is in the northeastern states? What percentage of the total population of the 25 urban groups is in the urban groups of these states?

4. How are New England manufactures affected by the lack of local coal deposits?

5. Make a detailed study of New York as a type port. Consider depth of water, extent of shoreline, protection from winds and waves, contact with interior United States and the world oceans, government improvements and aids to navigation, warehouses and facilities for transfer of cargoes, and other items.

6. Many of the large manufacturing companies operating in these states publish excellent booklets that will furnish much basic material for the working out of excellent type studies. The following is a list of possible studies that are typical of the industries of these states: The Pennsylvania Railroad, the Hammermill paper mill, the Baldwin locomotive works, the Connellsville coke region, the Douglas shoe factory, the Arlington mills, Lawrence, Mass. Each of these may stand as a type of industry. Emphasize geographic relationship.

7. What contribution to the settlement and the economic and commercial life of the United States has the coal of Pennsylvania made?

8. The petroleum industry had its start in Pennsylvania. Trace out the far-reaching influences that petroleum has had in the past, and has today, on American social and economic life.

9. Make a list of certain types of industries that are migrating or have migrated from New England to some other section of the United States. Give the major causes and effects in each case.

10. How have climate and geologic forces and processes given the Northeastern States large resources of water power? Consider each section of these states separately.

CHAPTER 5

Agriculture in the Northeastern States

THE DEVELOPMENT OF AGRICULTURE

Agricultural Adjustments. American agriculture, even as practiced today in the northern half of the United States, owes much to the farmers of colonial days and later. Along with the European colonists who founded Plymouth, New Amsterdam, and the other colonies came seeds and livestock and a knowledge of agricultural methods.

In the new environments in America, new adjustments had to be made, and this problem has ever been uppermost in the history of American agriculture. The fairly dependable oceanic climate of northwestern Europe offered few problems in crop adjustment to climate, in comparison with the fickle continental and littoral climate of northeastern United States. In the westward expansion of the agricultural frontier from the shores of the Atlantic, the farmers had to adapt their crops and methods of tillage to every grade of soil from gravelly and sandy to stiff clay, and to soils of every origin; to climates of the lowlands and of the highlands; to long growing seasons and short growing seasons; and in addition to constantly changing economic conditions as cities grew and transportation was improved. Naturally, they made many mistakes, but the trying conditions called for, and no doubt developed, ingenuity and adaptability, two cardinal virtues of the character of the people of the United States.

Tillage was formerly wasteful. New lands were constantly being opened up, and there was thus no pressure on the farmers to utilize the agricultural resources of any field or any region to the utmost. Agriculture, for 2 centuries or more, was largely migratory, a fact which accounted for the general lack of attention to soil erosion and depletion, and slowness of American people to adopt land and forest conservation methods. Each farmer migrated from old communities to new, and he migrated with his tillage on his own farm from field to field. "Summer fallowing" was common, instead of a carefully thought-out scheme of crop rotation. On many farms, even the manures were not used.

For nearly 2 centuries there was little attempt to evolve new varieties of crops suited to American conditions, and there were, with the exception of corn, peas, beans, pumpkins, and the grape, no food plants that had been developed from American plants. Native grasses have been utilized for fodder. Flint claims that the extensive and practical cultivation of natural grasses originated in North America, or at least was introduced here long before it was in England. Fortunately for the experimenters, this development took place in the hay and fodder region where conditions are most favorable. Timothy is an American grass, so named after Timothy Hanson, who was much interested in its propagation and who took seeds of this grass from New York to the Carolinas and even to England.

Not until improved transportation broadened the markets for the farmers and the commercial regime was ushered in was there a change from general cropping. Each community produced, for the most part, all the crops it needed, rather than crops that represented climatic and soil adjustment.

The Evolution of Agricultural Implements and Machines. The implements of colonial days were crude, handmade, and mostly of wood. The early plows, which were of wood, merely "disturbed" the soil and did not turn it over. The first farming in the Massachusetts Bay colonies, as in the other settlements, was largely "planting" and not real agriculture, for there were not enough plows to go around. The agricultural machinery age in the United States began about 1830. For several decades thereafter nearly all the patents granted were taken out by men from the northeastern states, and nearly all the agricultural-implement factories were in these states, no doubt a response to the rapid expansion of the farm area by the opening of the Middle West and the creation of a shortage of farm labor.

In the decades following 1900 the Northeastern States did not keep pace with the other sections of the country in percentage growth in value of farm machinery. The reason for this slow growth has sometimes been given as increased attention, in the Northeastern States, to dairying and gardening, where great applications of machinery were not made at first. The large areas of the Middle Atlantic states and the West were particularly applicable to machine work, and people adopted machines in a large way. However, since 1940, machines have been devised and used in all phases of work in dairying and gardening, so that between 1940 and 1950 the increase in value of farm machinery in New England was 70 per cent, and that for all other sections of the country was only about 60 per cent.

The Livestock Industry in the Northeastern States. In colonial days the northeastern section had many breeds of cattle, each colony having imported its own special favorites from its own mother country. There were breeds from Holland, Scotland, England, Sweden, and Denmark. Cattle were brought from England to Plymouth in 1624. In the selection of sites for new settlements, the presence of land suitable for cow pastures was an important item. The marshlands along the coast and those of the filled glacial lakes fed many herds.

There were really no pure breeds at this time, for scientific breeding was unknown even in Europe. Each county or region developed a strain peculiar to itself, in most cases the result of accidental rather than artificial selection. In most parts of the Northeastern States, oxen were used quite generally on the farms until about 1840. On the hill farms of New England they were in favor much later, as they were cheaper than horses and thrived better on the sparse grass of the hills. The building of turnpikes and the introduction of agricultural machinery made a demand for a much speedier animal, and the horse came into general demand.

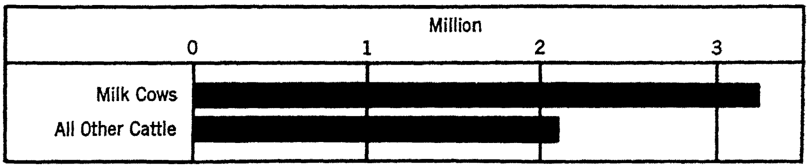

Fig. 66. Cattle on farms in Northeastern States in 1952. (The dominance of milk cows indicates the importance of dairying.)

The Dominance of Dairying Today. Most of the herds of the Northeastern States today are dairy cattle—about 3,240,000 out of a total 5,389,000 (Fig. 66). Commercial dairying began even before the Revolutionary War. Near some of the cities there were herds of 50–100 cows or more; with increasing urban population and improved transportation, the dairy farms increased in number. Farms within 200–300 miles of the cities now furnish milk and cream, generally through milk dealers who prepare, bottle, and distribute the product in the cities. Along some railroads, milk express trains are run. Electric cars and auto trucks are prominent in this transportation. In the parts of these states beyond the 5- to 8-hour run to some city, creameries and cheese factories turn the raw product of the dairies into butter, cheese, and processed milk—more concentrated and less perishable forms than the sweet or raw milk (Fig. 67).

Dairying will continue to be an important type of farming in the Northeastern States, and must increase. As a result of “better babies” and health campaigns, the per capita milk consumption is increasing. Nearly 77 per cent of the population of the Middle Atlantic states and more than 76 per cent of that of New England live in cities, and the urban population is increasing. Milk production must increase, therefore, within the sustenance area of the large cities. This may be accomplished by an expansion of the area devoted to dairying, by extending the radius from which milk is now drawn, by speedier transportation facilities, and by the selection of better breeds of dairy cattle.

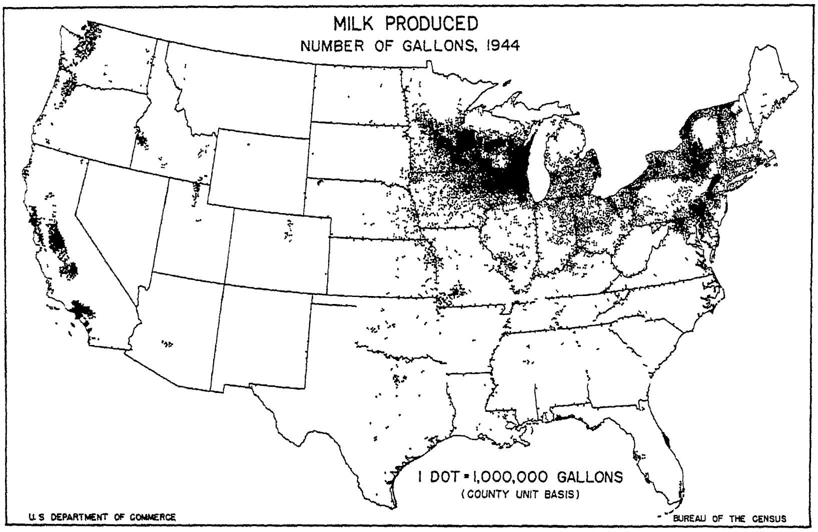

Fig. 67. New York and Pennsylvania were the greatest dairy states before about 1910. Wisconsin, Minnesota, and Iowa now exceed New York in the number of dairy cows, and Wisconsin and Minnesota exceed New York in the amount of milk produced. Since 1930 there has been a general increase in production of dairy products in all parts of the country, but the greatest increase was in the North Central States.

On some dairy farms, only the roughage is raised, the concentrated foods being imported from the grain-growing states of the Middle West. This practice may be extended. Many pastures are not now producing the maximum fodder because of continued cropping. Some pastures have been grazed continuously, it is claimed, for more than a century. Many could be improved by selecting a better variety of grass (Fig. 68).

A special type of dairy farming is to be found in some parts of the Northeastern States—the preparation of certified milk, often prescribed by physicians for delicate babies and even for mature invalids. There is a relatively limited market for this product, yet undoubtedly the profits are greater in its preparation than in the production of the common sort of milk. The dairy equipment is costly, for great care must be exercised in making and keeping the milk pure and clean.

The Sheep Industry of the Northeastern States. On January 1, 1952, there were some 31,725,000 sheep in the United States, but less than 500,000 in the Northeastern States. From 1910 to 1952 the sheep of New England declined from 431,000 to 57,000. There was a time when a sheep was considered a necessary animal on most farms, the wool being in demand for the making of clothing. Since 1800 the number has been declining gradually. Many breeds have been imported and tried. The Leicester, which originated in England in 1755, was one of the earliest to be tried out, but it did not become popular in New England until about 1860. The first merinos were brought from Spain to Massachusetts about 1801. Because of their fine wool they were in much demand, and by 1811 nearly 20,000 had been introduced. Western wool, however, brought about a decline in the number of merinos in the Northeastern States. The Dorset, a mutton variety, is now in favor with sheep raisers who specialize in the production of "hot house" lambs. The lambs, born early in the winter, are fattened by forced feeding and extra care and are ready for market in 60 days.

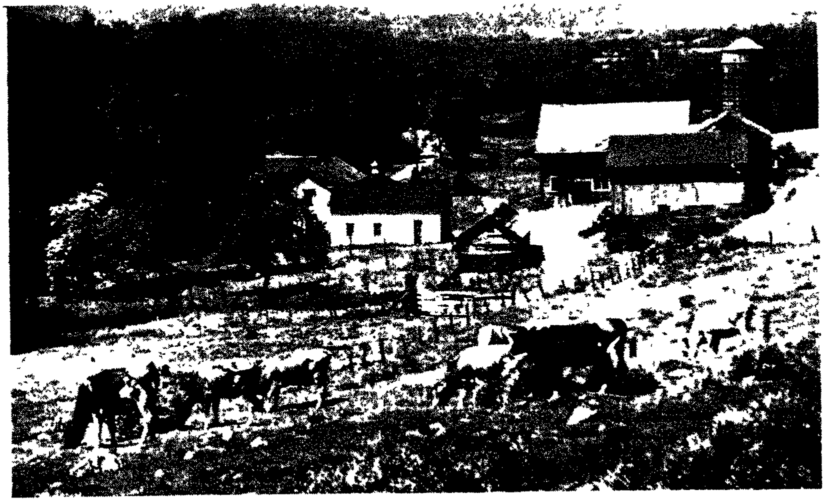

Fig. 68. A typical dairy farm in New England. *Courtesy, Berkshire Hills Conference.* There are a great number of large dairy farms in New England with extensive barns and equipment, but perhaps a large bulk of total dairy products comes from the many small dairy herds consisting of from 8 to 15 head of cows.

The increasing density of population and the intensification of agriculture do not necessarily mean the passing of the sheep industry from the Northeastern States, for Great Britain has more than 300 sheep to 100 cattle, in comparison with about 13 sheep to 100 cattle in the Northeastern States. If sheep raising has a place in the farm economy of England, where manufacturing so completely dominates the activities of men, it certainly has a place on the farms of the Northeastern States. Sheep raising primarily for wool is a thing of the past; but the production of mutton with wool as a by-product should prove profitable, although Americans are not mutton eaters to the extent that the English are. The stony hillsides of the Northeastern States may well be utilized for sheep raising. Large-scale production will undoubtedly prove most profitable. Abandoned farms of the hill lands may be combined, and large ranges thus provided. The production of "hot house" lambs is another intensive form of the industry.

Contributions to Fruit Growing. Europe furnished America its first apple, pear, and peach trees, and the first of other varieties of fruit; yet the orchard fruits of today are more distinctly American creations than are the many grains and vegetables discussed elsewhere in this chapter, for the transplanted fruit has been modified in the new environment and hundreds of entirely new varieties have been developed.

The first orchard of New England was on Governor's Island in Boston Harbor, from which there were picked on October 10, 1639 "ten fair pippins." From eastern Massachusetts, seeds or nursery products were carried by Indians and whites to other parts of New England and even New York. In western New York, the earliest apples were probably grown from seed brought by the Jesuits. The propagation of orchard fruits has always been an important work of farmers and nurserymen. A farm with a valuable orchard was much prized, and no farm was complete unless it had an orchard. A knowledge of fruit tree propagating and grading was one of the many accomplishments of most of the ingenious New England and New York farmers.

Apples for the first century or two in America were raised chiefly for cider and for fresh fruit. Their storage in bins and root-houses extended the season of consumption. There was little commerce in them, because of poor transportation. Improved transportation gave growers a market and made apple growing profitable. For a time there was a boom in many parts of these states in apple growing; but overplanting glutted the markets, some investments failed to pay, and orchards were cut down to make way for other crops or were neglected. Only those sections with best transportation facilities survived as producers. New demands have developed since about 1930. Cold storage now gives us fresh apples the year round, and food specialists have quite convinced the public that the apple has a high food value.

Apple Growing Today. Apples are raised today quite generally over the northeastern states except in the undeveloped Adirondacks and northern New Hampshire and Maine. There are about 17,000,000 apple trees in these states out of a total of 65,000,000 in the United States (Fig. 69).

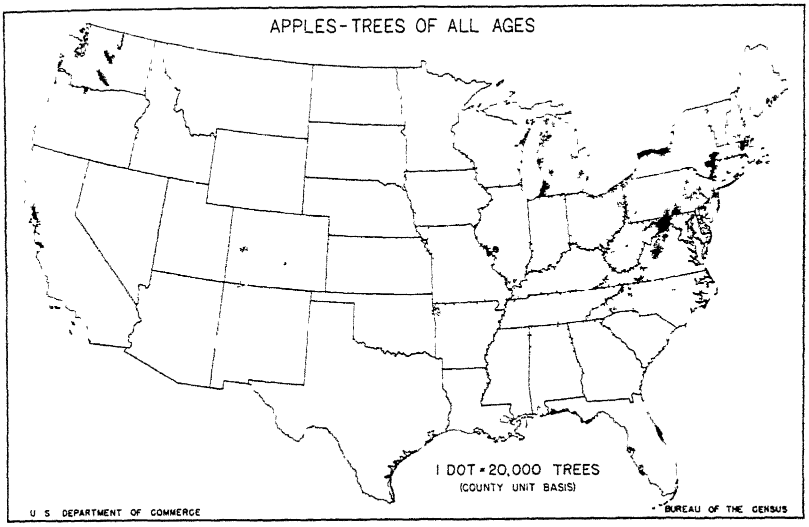

Fig. 69. Apple trees in the United States.

Massachusetts and Maine produce Baldwins for the New England markets. The more important commercial sections are northwestern New York, southern Pennsylvania, and western Maryland. New York for many years led all other states in apple production, but since about 1919 it has held second place to Washington, which has had a phenomenal growth in the number of bearing trees and production since 1909. Climatic conditions could hardly be better for fruit raising than they are in western New York near the southern shore of Lake Ontario where the largest orchards are located. In some parts of Maryland and Pennsylvania, slopes are selected to take advantage of air drainge.

The invasion of eastern markets by western-grown apples naturally leads one to a consideration of the future of this competition. With geographic conditions so favorable for the eastern growers, markets near, and excellent transportation facilities to these markets, it is surprising that western-grown apples can be sold on eastern markets while thousands of bushels of eastern apples of commercial quality rot in the orchards. The West has one great advantage in the relative ease with which diseases and pests are controlled, the great distances between the irrigated oases tending to check migration. But a 2000-mile freight bill must reduce materially the returns to the westerner. The success of the western grower undoubtedly lies more in the methods of marketing than in any geographic factors. In the West, in the Yakima and Hood River Valleys, for example, the apple is the leading money crop, whereas in the East it is the chief crop on only a few farms. Should the East in the future take advantage of its favored location and climate and adopt better marketing methods, it is difficult to see how the West can maintain a place in eastern markets for its apples.

The Peach-Growing Industry. Peach trees, because of their more delicate response to spring heat and their sensitiveness to winter cold, are restricted in their distribution to sections where early budding is prevented or where air drainage tends to reduce the damage from late frosts, and where the winter temperatures are moderate. Western New York near Lake Ontario, from the standpoint of production to the square mile, is the leading peach-growing section of these states. Extreme winter temperatures and the high range of spring temperatures make peach growing unprofitable in the northern parts of these states and the highlands of Pennsylvania. Since nearly 80 per cent of the peaches of the United States are grown south of the Mason and Dixon Line and in California, it is evident that the peach is a crop for sections that have warmer temperatures than most parts of these states. Pennsylvania among the Northeastern States leads in the number of bearing and non-bearing peach trees, with New York second. Pennsylvania also leads in production, but New Jersey is second. The New England states produced only 268,000 bushels in comparison with 5,700,000 bushels in the Middle Atlantic states and 68,000,000 bushels in the United States.

The apple and peach regions also produce pears, cherries, bush fruits, and strawberries. New York ranks fourth in cherry production after Michigan, California, and Washington, respectively. New York also ranks fourth in production of pears after California, Washington, and Oregon.

Rank in Grape Growing. Although the production of grapes is small in comparison with that of California, New York is the leading grape-producing state east of the Pacific Slope. The southern shore of Lake Erie in both New York and Pennsylvania and the slopes about the Finger Lakes of central New York produce more than 95 per cent of the output of the vineyards of the Northeastern States. Large bodies of water tend to retard the spring warming of the air and ground and thus delay the budding until the danger of late frosts is at the minimum. The grape of the United States, except the varieties grown in California which are from the European *vinifera,* is an American product. During the era of agricultural experimentation which characterized the colonial period, the European grape was tested out, but fungus and the insect *Phylloxera* blighted all attempts, and the grape enthusiasts were forced to develop the wild grape of the forests which was indigenous to a moist climate. The grape in Europe grows on well-drained soils or in regions of summer drought. The first well-known American grape developed was the Catawba. Its history began about 1802. The Concord was evolved in 1849. The names Niagara, Concord, Early Ohio, Delaware, and others attest to the American origin of the grapes grown in eastern United States.

The Development of Gardening. Practically all the vegetables now grown in United States truck gardens were also grown in colonial days from seeds imported from Europe. The Indians were raising beans, peas, melons, and pumpkins when the Europeans reached North America. These were probably developed from wild plants. From both of these sources, American and European, plant breeders developed a large number of varieties that are adapted to various forms of home gardening and commercial truck gardening, to the different climates found in America, and to the various tastes or whims of consumers.

A garden, like an orchard, has always been considered a necessity on most farms in these states. Not until the rise of the manufacturing city did commercial truck gardening become an important industry. The Northeastern States produce about one-fifth of the total for the United States measured by value. For commercial truck produce the leading five states are California, Florida, New York, Texas, and New Jersey, in the order named. Commercial gardening today is stimulated by the excellent markets offered by the numerous large cities. About every city there are market gardens, well-drained sandy land being much preferred because it is more easily worked and is warmer, and therefore matures plants more rapidly, than heavier soils. The terrace lands of the Connecticut, the outwash plains of Long Island, and the sandy lands of the Coastal Plains are the leading truck-garden areas. There are few other sections of the world where truck gardening has been intensified to such a degree as in parts of these states. Coldframes, hotbeds, and greenhouses are common equipment in many sections. The greenhouse makes year-round production possible.

Potato growing is practiced in many parts of these states other than Maine. Maine is, however, the leading potato-producing state in the Union, followed by Idaho in second place and New York third (Fig. 70).

Types of Farming in the Northeastern States. The farmers of the Northeastern States, like the farmers of other parts of the world, tend to adjust the type of crop they raise to the natural environmental conditions, the market demands, and effective competition from the outside. As for climatic conditions, all of this section, except northern New England and the Adirondacks, lies in the continental Hot Summer and Cold Winter temperature region (Figs. 4 and 9). Since the section lies near the northern border of the temperature region the hot months are few—one or two above 68°. In the coastal sections easterly winds bring in ocean air, and ocean air and the prevailing high relative humidity moderate the temperatures somewhat. Northern New England has a growing season of 90 to 120 days; the remainder of the section more than 120. There is a deficiency of sunlight, the areas receiving only approximately 50 per cent of that possible. The rainfall is moderate yet quite sufficient for all types of crops. Soil and topography have been discussed previously. Although the farmers of the last century or more, since the development of the railroad, have had a close contact with ready markets, they have had to compete (as suggested above) with the farmers of more distant sections who have utilized cheap virgin lands and who have commercial contact with this section by cheap, efficient transportation (Fig. 71).

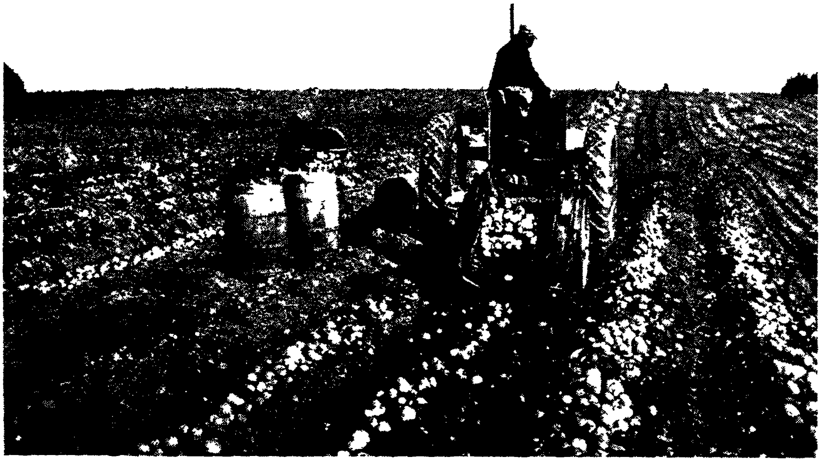

Fig. 70. Harvesting potatoes near Caribou, Aroostook County, Maine. *Courtesy, Maine Development Commission.* The potato does best in cool lands where summer temperatures do not exceed 65° F., where moisture is plentiful, and where soils are loose and easily worked. These conditions are found in much of the northernmost county in Maine—Aroostook.

Figure 71 shows in detail the types of farming which have been adjusted largely to the conditions listed above. It will be noted that specialized dairy farming is the most widespread of any type, and in it, dairying represents more than 40 per cent of all farm products. Note also that dairying is carried on in combination with other farming. Outside of the dairy, fruit and specialty crops, much of the combination types of farming in the Northeastern States is of the nature of self-sufficiency farming. This is most interesting for a section so long settled, and having adequate transportation facilities to ready markets. Under such environmental conditions one would expect commercial farming. A self-sufficient farm is one on which the products used by the family is 50 per cent or more of the total value of farm products. Some of the self-sufficient farms are occupied by retired farmers, business men, and professionals, and are located generally in the rough and remote sections of the country.

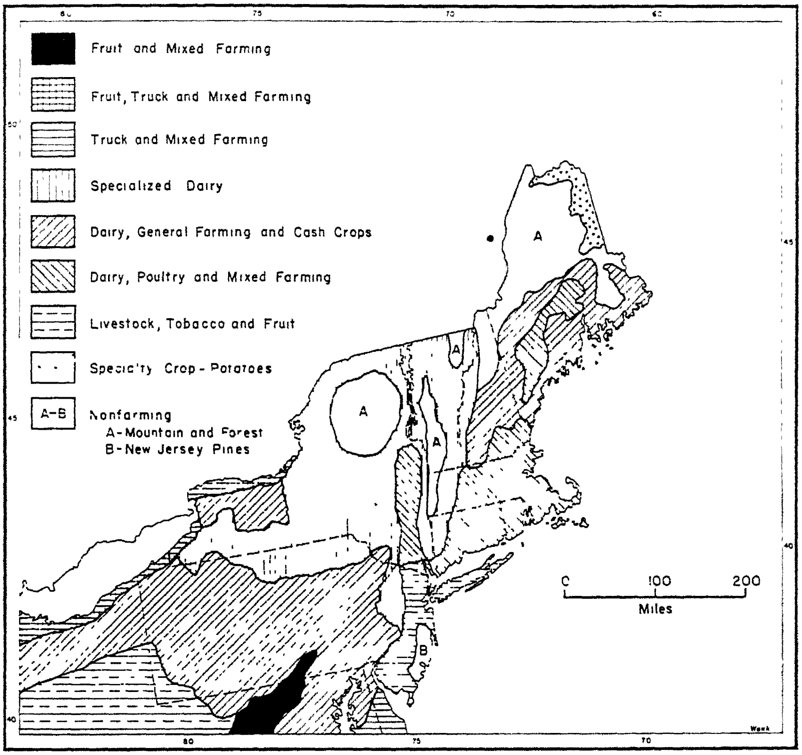
Fruit and Mixed Farming
Fruit, Truck and Mixed Farming
Truck and Mixed Farming
Specialized Dairy
Dairy, General Farming and Cash Crops
Dairy, Poultry and Mixed Farming
Livestock, Tobacco and Fruit
Specialty Crop - Potatoes
A-B
Nonfarming
A-Mountain and Forest
B-New Jersey Pines
A
A
A
A
B
0 100 200
Miles
75
70
45
40
80
75
70
45
40

Fig. 71. Types of farming in the Northeastern States. In a mixed-farming region several types of farming are carried on, none dominant. In regions of general farming there are several distinct sources of income on the same farm, none dominant. *Adopted from Bureau of Agricultural Economics, 1950.*

The map shows that several types of intensive farming are practiced. Besides dairy farming there is truck farming, fruit raising, and the raising of many crop specialties like potatoes and poultry. Where are these?

The active tourist and resort business in this section, as a whole, enables a small percentage of the farmers to earn part of their sustenance by taking boarders and lodgers. If the returns from boarders, lodgers, and campers represent 50 per cent or more of the total the farm is known as a boarding or lodging farm. This business is active chiefly in the summer. A small percentage of the farmers who have small holdings work part time in the forests or factories, and their wives and children do the daily routine work on the farms, largely specialty farms.

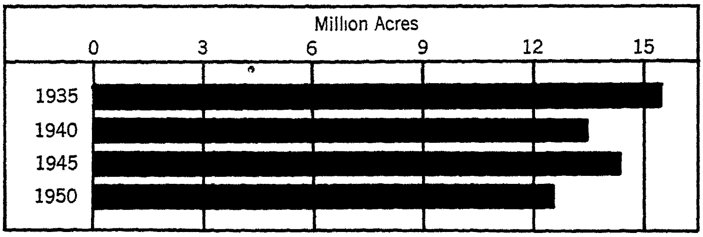

Fig. 72. All land in farms in New England 1935–1950 inclusive.

The Northeastern States in Comparison with Other Sections. The Northeastern States section is usually thought of as a great manufacturing region. Elsewhere it is shown that, although this section is not a great agricultural region, in comparison with the North Central States or the South, it holds an important place in the history of American agriculture because it was for two centuries or more the experimental area for a good part of the nation, for garden, orchard, and field crops imported from Europe. In statistical comparison made with other sections of the country—North Central, South, and West—involving totals for these sections, the Northeastern States often show up poorly. This is chiefly because of the small area of these states; New England occupies only 2.2 per cent of the total area of the country; the Middle Atlantic States, 3.4 per cent; and both only 5.6 per cent in comparison with 25.3 per cent for the North Central group, 29.8 per cent for the South, and 39.3 per cent for the West. Although the density of population of this group of states is far greater than that of other major groups, only 27.2 per cent of the total population of the country lives in northeastern United States, in comparison with 32 per cent in the South and 30 per cent in the North Central area. Another fact should not be lost sight of in comparing the agricultural activities of various sections: only a small part of the population of many of these states is engaged in agricultural production. Only 8.4 per cent of the population of Rhode Island is rural, 10.6 per cent of Massachusetts, 17.2 per cent of New York, 17.4 per cent of New Jersey, 32.2 of Connecticut, 33.5 per cent of Pennsylvania, 42.4 per cent of New Hampshire, and about 65 per cent of both Maine and Vermont. Taking this section as a whole, almost one-fourth of the population is rural (Figs. 72 and 73).

When these facts are given full consideration, it is easy to show that the northeastern region, besides being the greatest manufacturing section of the United States, ranks exceedingly high in agriculture. This section, which has only 5.6 per cent of the area and 14 per cent of the rural population of the United States, produces about 7.6 per cent of all field and orchard crops, vegetables, and farm gardens, 16 per cent of the truck crops (in value), 10 per cent of the fruits and nuts (in value), and 26 per cent of the horticultural products of the United States. It has 15 per cent of the acreage of hay and forage of the country, 9 per cent of the livestock on farms, and 13 per cent of the dairy cattle. And yet only 26 per cent of the total area of New England, and 46 per cent of the Middle Atlantic states, is in crops and pasture. Evidently the farmers of this section of the United States are contributing their quota and more to meeting the demands the nation makes on the holders and operators of the soil.

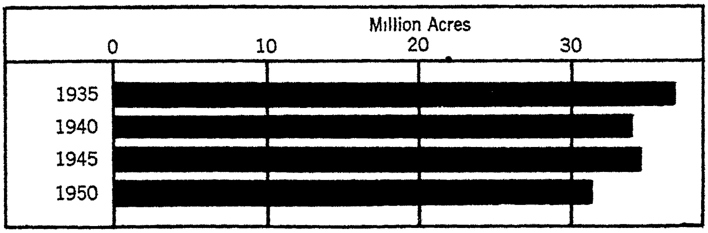

Fig. 73. All land in farms in New York, New Jersey, and Pennsylvania, 1935–1950 inclusive.

Agriculture today in many parts of the Northeastern States is in the intensive stage, as previously suggested, yet only a beginning has been made in intensification. Intensive agriculture, fully developed, means the continuous use of the soil during the growing season, the growing of high-profit-yielding crops, the employment of labor the year round, and a handling of the soil such that there will be no depletion. Intensification at present, in most of these states, is represented by the production of special crops or products, as orchard fruits, garden truck, small fruits, tobacco, potatoes, onions, cranberries, dairy products, nursery stock, garden and flower seeds, and greenhouse products. In only a few of these have the farmers an appreciation of the degree to which intensification may be carried. In the production of orchard fruits and the marketing of the products, the eastern farmer has much to learn from the western. Much of the truck gardening is little more than single-crop farming, with little appreciation of the need of a carefully thought-out rotation scheme. Dairying, although not using the land to produce the most profitable crops, is an all-year-round industry. As carried on in most parts of these states, it depends upon the grain states for its concentrated foods. Undoubtedly, the ideal intensive agricultural unit is the farm of general or diversified agriculture, an early type, which is represented by the agriculture of Lancaster County, Pennsylvania.

SELECTED TYPE AREAS

Agricultural Adjustments in Plymouth County, Massachusetts

It is fitting that we begin the study of agricultural types in the Northeastern States with a consideration of the oldest farming section of the North, Plymouth County. Here on the shore of Cape Cod Bay, the Pilgrims landed in December, 1620. The next spring they began the planting of maize in small plots, which the Indians had used for this pioneer cereal. Maize soon became the staple crop. In addition to supplying the needs of the colony, it was sold to the fishing villages up and down the coast. Wheat also was sown, and likewise a variety of vegetables. As time went on, horses, cattle, sheep, and hogs were introduced, and thus was established one of the nuclei of the livestock industry of the North.

Selection of Lands. To the little agricultural settlement on the shores of Cape Cod Bay, as population increased by natural increment and by immigration, lands were added and the pioneers began in earnest their conquest of an inhospitable agricultural environment. For the most part, only the best lands were used. Areas of thin soil, sandy ridges, mucky or boggy lands were left in their natural state. On the better lands, forests of white pine, oak, beech, maple, hemlock, and other trees had to be removed, and some farms had literally to be reclaimed by the removal of tons of erratic boulders an acre.

The conditions that prevailed in Plymouth County are fairly typical of many parts of the Northeastern States; yet under these seemingly adverse conditions has developed an honest, upright, enterprising, painstaking type of citizen to whom credit must be given for most of the great progress that has been made in agriculture, and in other fields as well, in the North from New England to the Pacific. The New England environment has put its stamp on the people who have labored long and honestly to gain a livelihood. The New Englander of the old school may have been provincial and conservative, but he was the sort needed to give solidarity to a developing civilization in the American environment, most phases of which tend toward economic superficiality in the development of the resources.

Farm Activities. The early New England family was large, often numbering a dozen or more. The necessity of feeding and clothing so many persons, coupled with the shortness of the growing season, the climatic limitations for many crops, and the patchy distribution of the deep soils on most farms, forced the head of the family, as well as the mother and older children, into habits of work and economy. Each household was an economic unit in which farm implements, furniture, and clothing were manufactured during the long winter months. Leather was tanned, cut, and sewed into harness, shoes, and boots. Many houses had forges and anvils near the chimneys at which iron was heated and hammered into nails, runners for sleighs, tires for wheels, and straps for plows. Clothing was made from wool grown, spun, and woven at home. Such conditions no doubt tended to develop the mechanical ingenuity that is characteristic of so many Americans, and aided greatly in the development of manufacturing in New England at a later date.

The fields were planted or sown mostly to supply crops. Gardens, and orchards of apples, pears, and cherries were planted on nearly every farm. The system of tillage was similar to that prevalent in England at that time, and this system continued in use down to the middle of the nineteenth century. Indeed many of the farms of Plymouth County remained in possession of descendants of the original families until that date. Until the coming of the railroad about 1840, when access was had to the growing industrial centers, there was little to force the farmers to change from this system of general farming to special crops and intensification. Migration to the better agricultural sections of the Lake states and the constant drift to the cities, as they expanded in industries and trade, kept the rural population nearly stationary in density. The great age of the communities, the meager though sufficient returns from the lands, and the constant migration of the younger and more venturesome and progressive from the farm kept the rural people conservative. There is nothing quite so fixed as an agricultural community after it has once reached the limits of its areal expansion of cultivated lands and its markets have become fixed.

Some Economic Adjustments. The growth of cities made increasing demands for agricultural products, but the urban population was small in comparison with the rural. In 1700 Boston had a population of about 7000, whereas the population of New England was 105,000. By 1763, when New England had grown to 510,000 people, Boston's population was between 15,000 and 20,000 and there were few other urban groups. Poor roads restricted the sustenance area of the cities to lands within a 40- or 50-mile radius. Coast towns, however, had much larger commercial areas.

From 1840 to 1860 was a prosperous period for the farmers of Plymouth County and other parts of New England. The railroads opened up new markets, but new dangers arose. Gradually there came an increasing flood of products from the rich plains of the Middle West, as railroads reached farther west. These came to compete with those raised with much toil on the scanty, patchy soils that had already been producing for a century or two. The railroads also expanded the markets for the manufacturers of New England, the factories grew in size and multiplied in number, and the drift of laborers to the cities increased. Many farms were abandoned outright; others were unworked. In 1880 there were 86,000 acres of improved land in Plymouth County, out of a total of 194,787 acres of farm lands; but in 1910 there were only 50,200 acres improved and 137,000 acres in farms. In 1950 there were only 105,860 acres in farms and 34,560 acres in crops. Figure 72 shows the change in acreage in improved farm land in New England since 1850 and 1860.

Since about 1920 many farms have been purchased as country homes, the suburban trains and the automobile making it possible for the office man to live 25, 50, or more miles from his work. Some farmers, who were more adaptable to changing conditions than others and were able to weather the adverse times and hold on, have enlarged their acreage by purchasing adjoining farms; yet in many parts of New England farms have been divided into 10–15 acre plots and sold to European immigrants who grow berries, poultry, and garden truck by intensive methods, the women and children furnishing most of the labor, although the man of the family, who generally is a factory worker, assists at spare times. Now there are few abandoned farms to be found in this part of New England. One finds, on all the better soils, well-kept farms that have an air of prosperity, refinement, and contentment about them.

Present Conditions. Although general farming continues on many farms and the system of colonial days is little changed, corn, hay, oats, barley, beans, and potatoes being raised, there has been a decided improvement in most communities. Dairying has become an active industry on the larger farms, milk and cream being shipped to Boston and other industrial centers. Potatoes and garden truck come from the lighter soils;

and since about 1910 the bogs, which for more than 300 years were considered worthless, have been improved to grow cranberries. Some years more than two-thirds of the cranberries poduced in the United States come from Massachusetts.

Bog reclamation is generally done by companies who lease the land or buy it outright. The cost of improving a bog is high. Unimproved bog or muck land sells for $25–$100 to the acre, bearing cranberry land for $100 or more. If the muck land is forested, the trees are cut and the roots dug out. If the muck is thick, some of it must be removed. Ditches 2 or more feet deep are excavated, to drain the lands in wet weather or to irrigate them in dry seasons. Only such bog lands as may be drained and irrigated are improved. Water is wanted especially in the fall, to protect the berries from frost, for the harvest runs into late September and even later, and for this reason bog lands along streams are in greater demand. Over the surface of the muck, a 3-inch layer of sand is spread. This makes the land firm, and in this the plants are set about 3 feet apart. It takes 3 years for the plants to reach bearing age. A thin layer of sand is applied each year; this reduces the cost of weeding and makes the gathering of the berries easier. At nearby packing houses the berries, with bits of the vines, are cleaned, sorted, and packed in barrels. The usual crop is 50–60 barrels per acre. Many of the laborers in the bogs are for the most part a floating type of worker.

The Camden Trucking Area

The Camden Area. There are few areas in the United States where crop adaptation and adjustment of systems of tillage to soil conditions have reached the perfection found in the Camden area of New Jersey. This is chiefly the result of the age of the region (the Swedes having planted the first colony here in 1637), the nearness to large markets, the excellent transportation facilities, and the high land values of the improved farms. As in all agricultural sections of the United States near large cities, the transportation facilities are excellent at present. Camden is the center of numerous steam and electric lines; ferry lines connect the city with Philadelphia; and small boats ply upon the lower courses of the river and give many farmers ready access to the wharves of Camden, Philadelphia, and nearby towns.

The area lies on the western margin of the Coastal Plain and borders the Delaware River. Bordering the Delaware are terracelike tidal flats which extend back into the westward-flowing streams some 5 or 6 miles. Some of the tidal marshland has been reclaimed by diking. Most of it can be reclaimed, but concerted action is necessary. Inland from this tidal area are remnants of two higher-level terraces that border the western edge of the marine-deposited Coastal Plain. The highest part of the Coastal Plain in the Camden area, 130–200 feet above sea level, lies about 12–15 miles east of the Delaware River, and, from this broad crest 8–12 miles wide, the land slopes westward with a gradient of 3–5 feet to the mile, but eastward much more gently. Beneath the general level the streams have cut valleys 100 or more feet deep, reaching tidewater level some 7 or 8 miles from their mouths. The streams have been at work long enough to develop broad, swampy flats in their lower courses, through which they flow in ill-defined channels.

In their lithologic makeup the soils have been derived—the mother material—from marine beds of sand, sandy clay, gravel, greensands, and marl or glauconite. The mother soil material on gentle slopes in a deciduous forest environment has become gray-brown in color. There is little iron, alumina, or lime in the upper portions of the mature soils. The sods are only slightly acid. Soil students class these soils in the Gray-Brown Podzol group. (See full discussion in Chapter 2.)

On the deep, well-drained, warm, sandy soils are truck gardens of 20–40 acres. Tillage with light equipment is possible. Here are grown such early vegetables as tomatoes, asparagus, peas, beans, sweet potatoes, and sweet corn. Asparagus, sweet potatoes, and early Irish potatoes are generally grown on ridges thrown up by the plow. Berries are also a large crop. The heavier sandy loam grows medium late vegetables, as Irish potatoes, tomatoes for canning, cabbage, peppers, beans, peas, corn, general farm crops, and such orchard fruits as apples, peaches, and pears. On the heavier soils are general farm crops and dairying. Here the farms are, as a rule, 100–160 acres.

Types of Farming. At present there are several types of farming: trucking alone; a combination of general farming and trucking; and fruit raising or dairying. Dairying is important in many sections, especially on those farms where the land is suited to the growing of hay or where there is natural pasturage. The 6-months' growing season and the tempering influence of the waters of Delaware Bay and the Atlantic (when the wind is from the east) favors, as does the soil, the growing of fruits and vegetables. The rainfall is about 46 inches and is well distributed during the growing season. Droughts are uncommon. The driest year on record had 36 inches of rainfall.

Present Conditions. Since about 1940 the number of large farms has declined and the number of small farms has increased. The area of farm land is only about two-thirds that of 1920. The following data present pertinent facts about land utilization for Camden County, New Jersey.

	Acres		Acres
Total land area	141,400	Corn acreage	2,160
All land in farms	33,390	Hay crop	1,640
Average size of farms	35.9	Area in potatoes (Irish and sweet)	1,690
Land in crops	23,850	Land in orchard fruits	2,290
Plowable pasture land	2,320	Woodland (total)	6,950
Area in vegetables	4,890		

Diversified Farming in Lancaster County, Pennsylvania

Lancaster County, in southern Pennsylvania and bordering on the Susquehanna, is partly a Piedmont, with soil derived from schists and gneiss, and partly a limestone county. Its fame as the leading agricultural county of Pennsylvania rests mainly on the limestone soils which cover more than a third of the area.

Environmental Factors. About half the area of the county is lowland, limestone plains, and bottom lands; the remainder is upland plateau, and hills of meta-igneous rock, the typical Piedmont rock, which stands from 200 to 600 feet above the limestone lowlands. The limestone lowlands extend east and west across the county. In the upland sections the streams have cut deep valleys, making some of it too rough for cultivation. The gradient of the streams is for the most part low, for they have been long at work, and a rainfall of 40 inches or more, well distributed throughout the year, makes them perennial, particularly those fed by underground water in the limestone area. The valleys in some parts are deep, and thus some of the land is too rough for cultivation. Gristmills were established in the early days at a few points along the streams, particularly on the borders of the lowlands.

The area has always had, since its settlement, the advantage of the best transportation. The first long turnpike of Pennsylvania, the Philadelphia-Pittsburgh Road, passed through the city of Lancaster. The low relief, deep soil, and easily excavated rock of the limestone plain were the chief factors that led the engineers to lay out the eastern section of the Pennsylvania Canal through Lancaster, and this canal was soon paralleled by a railroad. With Philadelphia but 60 miles distant, and Baltimore about the same, excellent railroad connections to the East, and numerous small manufacturing cities within the county itself, all connected by excellent roads, the farmers have always had accessible markets. But they have been, since about 1850, on a fairly direct railroad line, the Pennsylvania, to Pittsburgh and the North Central States, and have had the competition of farmers of the Middle West to meet. These are the leading physical and economic factors to which man has adjusted his agriculture in Lancaster County.

Agricultural Adjustments. The first settlers, Swiss Mennonites who secured land from William Penn, came in 1710. They were followed by Germans, French, English Quakers, and Scotch-Irish. The Swiss and Germans selected farms on the limestone lowlands; the Scotch-Irish, by necessity and in some cases perhaps by choice or lack of foresight, settled on the crystalline uplands in the southern part of the county.

During the entire history of the Lancaster section, general farming has been the rule. In the early decades it was extensive, becoming more and more intensive as larger markets developed, better transportation facilities were provided, and land values advanced. The majority of the farmers during most of the agricultural history of the country have been careful, painstaking husbandmen. Livestock has always had a fairly important place on the farms. Barnyard compost and careful rotation of crops have always been leading factors in the maintenance of soil fertility. The natural fertility of the limestone soils has favored the farmer; long leaching, however, makes the liming of the soils necessary. Corn, wheat, and tobacco are the chief crops used in the three-, four-, or even six-year rotation schemes. Fertilizers are freely used. The money crops are varied: potatoes, wheat, tobacco, fruit, vegetables, dairy products, and beef cattle.

Wheat and corn were the chief field crops in the early decades. Spelt was the form of wheat raised for fully a century, then came several varieties of wheat. Tobacco has long been raised and is the chief money crop on most farms, and varieties peculiar to Lancaster County conditions have been developed. There is a prevalent local belief that the soil and climate of the section is the chief factor in giving the quality and flavor to the tobacco, and that any variety will, if planted in the section, in a few years take on the character of the Pennsylvania tobacco. The limestone soils produce as high as 2500 pounds of tobacco an acre, whereas many fields in crystalline rock produce only about 900 an acre. The tobacco is used chiefly for cigar filler and binder. As in other parts of the United States, only a small part of each farm is devoted to tobacco raising, the patches varying from 2 to 20 acres.

There are few commercial apple, pear, or peach orchards. Dairying is important on some farms, but on others not enough cows are kept to supply the families with milk, cream, and butter. Winter fattening of cattle has long received much attention, the lean cattle being purchased at the stockyards in Lancaster. From 100 to 400 carloads are received daily during part of the fall. The roughage and most of the grains used are grown on the farms of Lancaster County. About 82 per cent of the total area is farm land, and 60 per cent of the total is in crops. Lancaster is one of the wealthiest counties in the state, the average value of land and buildings to the farm being $20,500.

Diversified Agriculture on the Allegheny Plateau

Clearfield County in central Pennsylvania may be taken as a type agricultural area of the Allegheny Plateau where the urban population is small but where numerous railroads give access to many markets.

Physical and Economic Setting. Although located to the west of the Allegheny Front, most of the land lies at the headwaters of the west branch of the Susquehanna and, therefore, is deeply dissected. The valley flats in the northeast corner of the area lie only 850 feet above sea level, whereas the watersheds between the tributaries have elevations of 1700–2500 feet or more. The land is, therefore, steeply rolling to hilly.

Flat to gently rolling land is found on the narrow floodlands and the broader interstream areas. In the north where sandstones and conglomerates outcrop, the surface is wild and picturesque. Here the land is poor; the slopes are steep and consequently stony, or have thin soils. This portion is little used for farming, being held by lumber companies and hunting clubs. About 60–75 per cent of the county, however, is underlaid by shales and sandstones that bear workable coal seams, hence coal mining serves to give employment to some urban dwellers. The largest city has a population of about 11,500; the second in size, about 9000; numerous small villages ranging from a few hundred people to 2000. These cities furnish a limited local market for certain products of the farms, but coal mining and the revenue that comes to some of the farmers from coal leases detract seriously from agriculture.

The sawmill towns of the early nineteenth century furnished a small market for some products but apparently affected the general run of farmers but little. After the coming of the Pennsylvania Railroad in 1869, there was a decline in agricultural activities in the southern part of the county, due to an increased attention to lumbering and mining; and mining is still a factor interfering with a better and more active utilization of the agricultural resources.

Present Conditions. Today less than a fourth of the total area is in farms, and the cropland is about one-eighth and the pasture land about one-twentieth of the total area. The farmer has therefore made only a beginning in land utilization. Agriculture is diversified, the average annual rainfall of 44 inches and the growing season of 120–150 days permit almost any crop of the cool temperate zone. Besides the field crops common to northern United States, nearly every farm grows vegetables for home supply and for the local market, and has a small orchard with apple, plum, and cherry trees, a berry patch, dairy cows and beef cattle, and pigs. There are no large truck gardens, only a few young commercial apple orchards, and, except near the towns, no large dairies. Some poultry is found on every farm. It is evident, then, that the farmers still have much to accomplish before they can derive the maximum advantage from their agricultural opportunities. Diversified farming calls for a complete equipment. The farms are large, outbuildings numerous, often including a silo, and the farm machinery is varied, consisting of wagons, plows, cultivators, harrows, rollers, seeders, binders, and mowers. The houses are well built and well kept. More than 88 per cent of the farms are operated by the owners.

The Fruit Region of Northwestern New York

Early Importance. The date when fruit growing began in northwestern New York is unknown, for when American settlers entered the section just after the Revolutionary War they found that the Indians had for many years collected apples of European varieties. It is thought that seed had been planted by the French missionaries who visited the Indians about the middle of the seventeenth century. The American settlers brought apple seeds and stock, and there were bearing orchards west of the Genesee River by 1800. The Erie Canal and the railroads to Buffalo, New Yory City, and Boston opened up larger markets for the apple growers of northwestern New York. Commercial apple growing dates from 1860, and grape culture from about 1865 or 1870. Since these dates vast orchards of apples, peaches, pears, and cherries, besides large vineyards of grapes and many hundreds of acres of small fruit, have been set out, and the region has become the most important temperate-zone fruit region east of the Rockies. New York before about 1930 led all states in the production of apples but now holds second place. In few other places in the United States have the trees retained their vigor as in New York. There is certain to be a decline in the apple crop, however, unless more planting is done.

Wheat and corn were the first crops raised by the American settlers, and the Genesee section before 1840 was celebrated as a wheat region. Before the opening of the Erie Canal in 1825 wheat was grown mainly for local consumption, for contact with the larger markets was had only by ox-wagons. The cost of transportation to New York City by this means was three times the price of the wheat. Flour mills were erected in 1820 at the falls of the Genesee River at Rochester, and flour was shipped to Canada by way of Lake Ontario, and to Buffalo and the East after the opening of the Erie Canal. With the settlement of the cheap prairie lands of Illinois, and later of Minnesota and Dakota, the area of commercial wheat growing was expanded greatly, and although the Genesee region continued to produce about as many bushels as formerly, relatively its output was, and is, so small that people no longer think of it as a wheat-growing section. The yield to an acre is greater now than in the wheat regions of the Middle West and greater than it was 75 years ago, a testimony of the careful tillage practiced.

Physical Factors. Monroe County, which we are taking as a type area of northwestern New York, has a variety of soils. Most of them are lacustrine in origin; even the glacial deposits, in most instances, were deposited in glacial lake waters. Crop adaptation to soil is a problem that the careful farmer has attempted to work out. Glaciated land, because of the great variety of soils generally found on even a small farm, offers exceptional opportunities for experimentation. The large industrial population of Rochester gives an admirable market for the products of intensive cultivation. Another factor influencing agriculture, particularly fruit growing, is the retarding influence of lake winds, previously noted, on the spring temperatures, tending to delay budding until danger from late frosts has passed. The farmers of northwestern New York, therefore, are operating under many favorable conditions. The air of comfort, refinement, and prosperity that is seen on every hand is evidence that they have actively developed the advantages of their environment. Nearly all the land of Monroe County outside of Rochester is in farms, and about 82 per cent of the farm land is improved (cropland and plowable pastures).

The fine sandy and sandy loam and muck soils are used for garden truck, early potatoes, nursery stock, small fruit, peaches, and cherries. Grapes are also grown on this soil near Lake Ontario. For apples and pear orchards, loam soils are generally selected; and the clay loams and heavy clays are used for growing grains and grass.

Diversified farming is the rule; but fruit growing, truck gardening, potato growing, and dairying are special forms to be found, rarely more than one on any one farm, throughout the county.

QUESTIONS, EXERCISES, AND PROBLEMS

1. Make a statistical comparison of the agriculture of two counties in Pennsylvania, one well over on the Allegheny Plateau (Indiana or Somerset County) and another on the Piedmont (Chester County). The latest Census Report will supply data. The selection of the items is left to teacher and students.
2. What tendencies toward intensification of agriculture are in evidence in the northeastern states? What are some of the probable causes of this tendency?
3. Make a graphic comparison of the changes from 1850 to 1950 in number of farms, acres of land in farms, and improved land in farms in New England, the Middle Atlantic, East North Central, West South Central, and Pacific States. Volume 1, *Census Report*, 1950, will supply data. Discuss the graphs.
4. Compare changes in percentage of total land area on farms and of improved land on farms in United States, New England, the Middle Atlantic, West North Central, South Atlantic, and Mountain States. Write your conclusions.

5. What portions of the United States and other parts of the world contribute to the food supply of New York? How has improved transportation affected the area of New York's sustenance space? Trace out the development of improvements affecting transportation.

6. What natural conditions, climatic and topographic, have been taken advantage of in fruit raising in the Northeastern States?

7. Does California or New York possess the better natural conditions for drying fruit? Which one will be likely to win out in the struggle if natural conditions dominate?

CHAPTER 6

The Fishing Industry in the Northeastern States

Introduction. In 1784 the Massachusetts House of Representatives voted to have hung in the session room a "representation of a codfish . . . as a memorial of the importance of cod fishing to the welfare of the Commonwealth." It hung there until 1895, when, after a careful investigation of its history and in accordance with a vote, it was removed to the new chamber, where it may be found today, "an emblem significant of the hardiness, courage, and faith of those who dare and defy. . . ."

Fishing was the first American industry, antedating even the first settlements. Indeed, it was chiefly the fisheries off northeastern North America that led to its settlement. Within 6 years after the discoveries of the Cabots, the ships of the French fishermen from Dieppe and St. Malo visited the banks of Newfoundland. By 1517, vessels of many nationalities—French, Portuguese, Spanish, and English—to the number of 50 and, by 1577, 315, had crossed 2000 miles of stormy sea to take the cod.

The first fishing voyage to the coast of which is now the Northeastern States was made by Gosnold in 1602. He named Cape Cod as a memorial to the "luck" he had near its stormy shores. His glowing accounts of the richness of the fisheries and the evidence he presented interested several merchants and fishermen. In 1607, cabins, a storehouse, and a small fort were built near the mouth of the Kennebec River as a base for fishing on the Maine coast. The first ocean vessel launched in America was built here and subsequently made several voyages across the Atlantic.

Before the Leyden Pilgrims landed at Plymouth, English, French, and Dutch fishermen had become fairly well acquainted with the northeastern coast of the United States. During the 6 years before 1620, 26 vessels had fished on the coast with great success; and by 1624 from 40 to 50 vessels from England visited the fisheries yearly, and fully 250 sails, employing 5000 persons, operated on the Newfoundland banks. Fishermen, therefore, opened the way across the trackless ocean for settlement, and fish was the first natural resource of the American continent to be exploited by Europeans.

Many of the early settlements of New England were planted to exploit the fisheries, and fish on more than one occasion kept the colonists from starvation. Fish, furs, and timber were the first products carried to Europe to purchase the necessities that could not be had in America. The very nature of the industry, as carried on in the early days, bred democracy, for the fish were free for the taking, and, until large vessels came to be built, almost anyone, or at the most a small group of men, could provide themselves with the necessary appliances. The colonists, therefore, opposed all attempts on the part of the English Crown or the colonizing companies to establish fishing monopolies; and, no doubt, it was this same spirit of democracy, bred by nearly two centuries of free life on the sea in the fisheries and in ocean trade, combined with the fact that the sea was the chief basis of their economic existence, that led the New Englanders to defy the British Government in its attempts at the enforcement of the Navigation Acts of 1672 and 1696, the Molasses Act, the Sugar Act of 1764, and other acts that had for their aim the destruction of American fisheries and commerce. Within a month after the passage of the last of these acts the Revolutionary War began.

Perhaps most important of all is the fact that fishing encouraged the establishment of sea trade and manufacturing in New England history. Whale fishers who rounded the Horn in an oceanwide search for their quarry, discovered the possibilities of trade in the Pacific and with the Orient. Their ships became the connecting link between the eastern United States seaboard and the Pacific, and yielded large profits. Manufacturing in New England was stimulated because fishing expeditions demanded supplies, and returning vessels brought back raw materials to support industries. Pork and salt-meat packing, biscuit manufacture, clothing and brass industries, and the making of barrels, hoops, kettles, and salt, all began for the purpose of supplying the trading vessels. Returning ships brought sugar, metals, and many other products which stimulated manufacturing. Sugar started the refining and distilling industries, hides supported shoe manufacturing, gold and silver went into the jewelry industry, and various fibers, but mainly cotton and wool, supported textile manufacturing. The fact that New England was lacking in many raw materials from the home land did not hinder manufacturing. Returning vessels from all parts of the earth took care of that. Capital from the fisheries, and water power, were put to use at home. Thus fishing, sea trade, and manufacturing were intimately related, each supporting the others.

For two centuries, or more, a young man in New England had few opportunities open to him, other than those related to the sea. Fisheries were dominant. However, there has been a decline in relative importance of fishing in the economic history of New England, the extent and nature of which is reserved for later discussion.

Environmental Conditions Favoring Fishing. We have seen the ill effects of glaciation on agriculture in New England. The meager opportunities in agriculture kept many people in the fisheries. Many of the earliest settlements were made by fishermen, it is true; but had the land offered the inducements that it did farther south, the hard life of the fisherman would have been abandoned by many for the easier and safer life on the land. Many a farmer was forced into winter fishing that he might have food enough to meet the needs of his large family. The long, cold winters gave the farmer a long "off season" for fishing; and the short, mild summers restricted the variety of crops.

The high latitude of the region and the cool Labrador Current gives cool waters, the natural habitat of a large number of edible fish known to Europeans and Americans. Fish from cool or cold water undoubtedly have firmer flesh and are more palatable than those from warm water; moreover, there is less danger of putrefaction, an important factor in localization before ice came to be used so generally. Ice was not used by vessels to preserve fish on the journey from the banks to the markets until about 1840. Now it is considered a necessity.

Geologic forces, previously described, gave New England many excellent harbors for the sheltering of vessels, the curing of fish, the mending of nets, and the repairing of vessels. From Cape Cod Bay northward the coast is rocky, with deep inlets, rocky headlands, islands, and sheltered coves. Southward, even to the tip of New Jersey, the shore is sandy, with shallow bays, sounds, and many lagoons. There are thus two distinct habitats for shore-loving fish. The broad continental shelf with its many "banks" brings deep-sea fish that summer near the ocean's bottom near enough to the surface to be caught readily. The nearness of the New England fishermen to the Bay of Fundy, Nova Scotia, the Gulf of St. Lawrence, the Newfoundland Banks, and even Labrador extended the area of fishing grounds. The fishermen of maritime Canada, until the last 50 or 100 years, have never been numerous enough to offer much competition, and in all these fishing grounds New England fishermen have had an advantage over those of Europe because of the shorter distance to the home markets.

The New England fishermen have always had cheap material for building their vessels and, most fishermen being adept in the use of ship carpenter's tools, built boats during leisure times. Little capital was needed, therefore, to enter the fishing industry. The vessels were staunchly built, seaworthy, and expertly handled. The nearness of some fishing grounds to the home ports had many advantages. The voyages were short Small vessels were used Vessels, in case of a storm, could reach a harbor readily and thus reduce the risk of life and property, and for that reason insurance rates were low Fishing could be pursued by many as a spare-time occupation, and many fishermen were aided by the women and children in the curing of the fish Until the invention of net-making machines, the women made many of the nets Fishing, especially inshore fishing, was somewhat of a family affair

The Earnings of the Fishermen Fishing has never been a very "gainful" occupation Until the large companies came into existence and success became a matter of expensive equipment, few fortunes were made The love of the sea, the possible chance of a good season, lack of knowledge of other industries, the "chains of habit," and pure inertia have kept many on the fishing grounds In the early days, before the dominance of manufactures in the economic life of the people, the traditions of the family and the education of the children were confined chiefly to nautical affairs By the age of ten many a boy had entered upon his period of apprenticeship "He aspired to the position of skipper of a schooner, possibly owner of the craft he was to command, and it was his ambition that led him, summer and winter, to face the storms of the Atlantic in preference to the fields and forests of the Middle West "

When agriculture, lumbering, commerce, and fishing were the leading occupations, the returns from fishing compared favorably with those of the others, but as new and rich agricultural lands opened up in the Middle West, the Great Lakes forests began to be exploited, manufactures developed in the East, and economic life became complex, fishing became one of the less gainful occupations The high price of fish since the 1930's has increased the income of the fishermen to some degree, but the catch is declining relatively, because the waters are being overexploited In 1950 there were in the United States a little fewer than 150,000 fishermen The value of the product was $320,000,000, making an average gross return of approximately $2100 a worker With reduction for interests on investments, depreciation, overhead charges, and other items, the returns must have been low indeed

The Value of the Fisheries. In total value of product and income per man, the fishing industry has not, particularly in the last century, compared favorably with other industries The product of the fisheries of the United States and Alaska in 1950 was $330,000,000, that of minerals $11,855,000,000, and that for net value of manufactures $90,000,000,000 The value of the catch of fish by Massachusetts in 1950 was about $39,000,000, but the output of the factories of that state in net value was about $2,000,000,000 New England fisheries in 1950 yielded

$58,000,000 worth of products, and those of the Middle Atlantic States $27,000,000

The strategic importance of the fisheries in the past and their influence in the development of overseas commerce, however, far transcends their economic value to the nation Naval and merchant craft are now little more than mechanical engines on which a boy from the farm, the factory, or the machine shop is as much at home as one sailor-bred. Before they assumed this character, however, the fisheries were the nurseries for seamen Besides being considered the "cornerstone of New England prosperity," the fisheries furnished men for the first navy, and in the Revolutionary War and the War of 1812 most of the privateers were manned by fishermen Bounties were provided from time to time by local, state, and national governments to encourage the fisheries

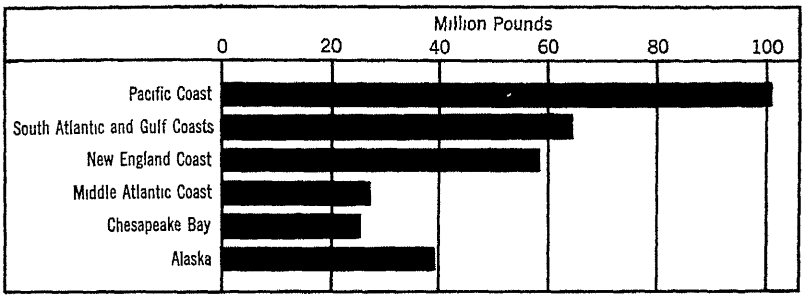

Fig 74 Value of fisheries of Alaska and the United States by sections, 1950

For a considerable time Alaska led in the value of the products of the fisheries of the United States After about 1920 New England was a leader, but in 1950 the Pacific Coast held first place, the South Atlantic and Gulf coasts second place, New England third place, and Alaska dropped to fourth place among the fishing regions of the country (Fig 74)

The Haddock This is a bottom-feeding "banks" fish belonging to the cod family It much resembles the cod in its habits of feeding and spawning, and is caught with the same type of gear It is marketed as "haddock on ice" or, if dried and smoked in the Scotch fashion, as "finnan haddies" or Finland haddock

The Cod. Of the deep-sea fish, the cod, until the Civil War, was by far the most important For more than two centuries the history of the New England fisheries was little more than the history of cod fishing To many a New Englander, even today, the cod is the best of food fish

Many diplomatic battles have been fought and treaties made with France, Britain, and Canada in the interest of the cod fishermen of New England

The cod lives for most of the year in salt water that ranges in temperature from 35° to 45°, and on a rocky or stony bottom at a depth of about 120 fathoms It is sometimes taken at a depth of 250 fathoms, and in the spawning season it moves into shoal waters near the shore

Fig 75 A familiar scene along the waterfront at Gloucester, Massachusetts *Courtesy, Gloucester Chamber of Commerce* In the foreground are seine boats used in mackerel fishing In the background are "bankers" and "draggers" used on the fishing banks Landings of cod, herring and other fresh ocean fish at Gloucester (since 1944) have totaled more than 210,000,000 pounds annually.

The stony banks on the continental shelf of the Gulf of Maine, the Grand Banks of Newfoundland, and other smaller banks, and the rocky submerged ledges and islands from Cape Cod northward are the best cod-fishing grounds in the world The most celebrated fishing grounds in the Gulf of Maine are Georges Bank, Middle Bank, Flippenies Bank, Jeffreys Ledge, Cashes Ledge, Blatts Bank, Grand Menan, Gormans Banks, Seal Island Grounds, and Browns Bank The cold Labrador Current keeps the water temperatures low and brings in fresh supplies of food

Sometime during the spawning season, October to April, the cod, both female and male, move into shoal water, and each female extrudes eggs to the number of 2,000,000-5,000,000 After being fertilized by the male, these float to the surface, where the sun hatches them in 12 to 21 days, and the small fry begin their struggle for existence The cod attains a weight of 4–5 pounds in 3 years, and many ultimately weigh 50–70 pounds, although most of the cod caught weigh 15–30 pounds The cod is a predatory fish, and a voracious eater, devouring any life small enough to swallow

The craft used in fishing for the cod vary from small sailboats manned by 2 men who cast their lines near the shore on the lee side of rocky headlands, to sailing schooners or auxiliary schooners operated by a crew of 15 to 30 men, which resort to the deep-sea banks and are, therefore, called "bankers" The typical "banker" today is about 120 feet long, has a depth of 10 or 12 feet, and a 25-foot beam The mainmast rises about 85 feet above the deck, with a topmast above this, 45 feet long It may spread 2000 square yards of canvas It has a gasoline engine of 75–100 hp and is roomy enough to give comfortable quarters to 15 to 30 men, besides having space for an ice house, general storerooms, and the storage of 300–400 barrels holding the catch (Fig 75)

Winter fishing is laborious and accompanied by many hardships Hauling in a mile or more of wet trawl from water near the freezing point on a winter day in a chilling wind and heavy sea is an occupation most people shun Besides, the fishermen are subject to many dangers Most of the time, when the catch is on, the dories are a mile or more and even several miles, from the schooner on the open sea Strong winds and the high seas may make it difficult to reach the mother ship A dense fog may set in, and the dory may become lost at sea with limited amounts of water and provisions Then may come days and nights of constant rowing to reach land or the "lanes" of the ocean frequented by trans-ocean liners The trawler operates both summer and winter, but winter fishing is more disagreeable

Comparative statistics showing the trend of the cod fisheries are difficult to obtain. Since 1940 there has been a decline, due probably to overfishing of the waters, in spite of the admirable work the fish hatcheries are doing to maintain an adequate supply In 1947 the Federal Government spent $1,500,000 in the United States and Alaska in the propagation of food fish More than 1,218,000,000 fry and 1,346,000,000 eggs were planted

Codfish may be purchased on the markets as fresh cod (iced or frozen), dried cod, "fish flakes" in cans, pickled cod, or salted boneless cod in the shape of bricks Only about 60 per cent of the "codfish" bricks are codfish, for hake and haddock are often sold under the name of cod.

Mackerel Fishing. Until about 1750, mackerel was used chiefly for bait, then the exporters began to send this fish, which they considered very inferior, to the West Indies to feed the slaves on the sugar plantations The West Indies had long been taking the inferior grades of fish After about 1820 the industry advanced rapidly The catch of mackerel fluctuates greatly It was low in 1910, and again in 1921 It rose to a high in 1939, declined again, then rose to another high in 1947 One year the catch may be 113,000,000 (1939) pounds, the next year 55,600,000, and the third year it may drop to 37,800,000 In 1950 it was less than 100,000,000 pounds Such uncertainty is extremely discouraging to mackerel fishermen, yet, with full equipment on hand and the possible chance of a very prosperous year, they hang on Some years, some vessels on a trip of several weeks may not catch sight of a single school of mackerel

The mackerel is the "mystery fish" of the deep-sea fisheries It is a warm-water fish and migrates northward with the northward movement of the sun It reaches Cape Hatteras about April 1, and the New England coast early in June Another body reaches the shores of Nova Scotia about July 1 With the coming of the winter it starts southward Its destination is unknown to man It is a surface-swimming fish, sometimes moving in vast schools that spread over several square miles, and again at times traveling in small detached groups. A small school may yield only a few barrels, a large one several hundred barrels A mackerel schooner is in most respects like the cod-fishing schooner The mackerel fishermen use a purse seine, which when open is a net 200 feet wide and a half mile or more long When closed about a school of mackerel it is like a huge purse

Herring Fisheries. The herring family, of which the leading varieties are the true or common herring, shad, alewife, and menhaden, is the most important of the commercial fish of the world The common herring has been for centuries the food of rich and poor alike on the coast lands of the cooler parts of both the Atlantic and the Pacific It is sold frozen, fresh, pickled, dried, or smoked The herring is caught in deep water off the coasts of Newfoundland, eastern Canada, and New England, and on the banks, but more often within the 3-mile limit in bays and inlets, where it resorts to spawn Here it is caught as it moves near the surface of the waters in great schools The young are taken on the Maine coast, canned in oil, and sold as sardines

The Rosefish Until 1935, the rosefish was scarcely known in the market Before 1928 less than 100,000 pounds were landed annually, but in 1936 the catch totalled 15,000,000 pounds and ranked third in species taken by New England fishermen The increase in production of this species has been rather regular It headed the list in species in the total United States catch in 1947. It is a ground fish found on muddy banks and around rocks below 50 fathoms, everywhere in the Gulf of Maine It is a year-round resident and has a range of temperature tolerance that resembles that of the cod (33°–50° F), hence the habitat extends northward off Nova Scotia and the adjacent islands It is a comparatively small fish (1–3 pounds) with bony structure and a large head, hence the edible portion forms a low percentage of the total weight For this reason shipping charges have prohibited its export, either to the interior or to foreign markets With the growth of the practice of filleting, rosefish have become an important commercial item in the fisheries, because the head and bony parts can be cut away and only the edible portions need stand shipping costs

With the irregularity in numbers of haddock, the large off-shore trawlers have turned to the rosefish. At present the favorite fishing grounds for rosefish are the bank below 50 fathoms just off CapeCod, and Browns Bank off the southern tip of Nova Scotia No doubt other areas will be tried as the demand for fish increases.

The Less Important Fisheries. Shad and alewife are caught in great numbers in nearly every inlet, bay, and river mouth from Florida to Maine, inclusive. They are anadromous, ascending the coast rivers to spawn, traveling hundreds of miles, in some cases, from the ocean where not checked by dams They have about abandoned some rivers because of water-power dams, chemicals discharged by industrial plants, sewage of cities, and muddy water from newly opened ditches. The rivers of Maine, Connecticut, Pennsylvania, and New Jersey furnish most of the catch from the Northeastern States Many of the New England rivers have been stocked with shad fry Through the activity of the many state fish hatcheries of some of these states, working in conjunction with the United States hatcheries, attempts are being made to prevent the extermination of this fish The alewife is considered superior to the sea herring as food, but not so good as shad. Like the shad, it is caught in large quantities in the lower courses of the rivers by means of pound nets, wires, gill nets, and seines

The menhaden is little used for food but is valued commercially for its oil and as a fertilizer, and as bait for cod and other ground fish caught by the hand line or trawl. Thousands of barrels are used by the cod fishermen in a single season for bait. The fish is taken by means of the purse seine, as it swims in schools numbering thousands of individuals, swimming in closely packed, unwieldy masses, helpless as flocks of sheep . . ." The extracting of menhaden oil was begun about 1850 on the coast of Maine. For many years, fisher-farmers operated hand presses, three or four families often forming a neighborhood company. The first factory was built in Maine in 1864 Now there are factories to be found in many coast towns from Maine to Florida, and since 1930 there has been a tendency for the industry to shift to the states south of New England

Lobster Fisheries The lobster is an inshore fish whose habitat is clear water on rocky bottoms, mainly from Cape Cod Bay northward It lives at various depths In the spring the mature lobsters migrate into shallow waters where they spawn, and here they remain most of the summer, returning in the fall to the deep water, 100 fathoms or more The lobster was caught in colonial days for food, but not until the middle of the last century was it an article of commerce

Oysters. The sandy coasts of New Jersey, Long Island, Connecticut, Rhode Island, and Cape Cod provide annually about $10,000,000 worth of oysters, although the industry belongs more to Delaware and Chesapeake Bays than to these sections In New England the industry is of recent development

Big Business Goes Into Fishing Fishing in New England and Newfoundland waters has, up to about 1930, largely been an individual or partnership enterprise The trim, fast-sailing fishing schooners are disappearing gradually, replaced by efficient steam trawlers on which machinery is doing much of the drudgery formerly performed by hand All these developments call for far greater capital than formerly, for ships and for marketing facilities Sonic depth finders—some trawlers are so equipped—give the exact location of the banks, and radio telephones enable the skipper and the crew to keep in close touch with the home port Accidents and sickness are reported A radio receiver on board gives the latest market prices, weather forecasts, and general happenings Machinery makes a smaller crew possible The schooner's crew usually numbers 15 to 20 men The steam trawler requires only about 7

The trawl is a huge conical bag 150 or more feet long, drawn through the water aft of the trawler that steams 2 or 3 miles an hour When not trawling the vessel's speed is about 15 knots The casting of nets is more frequent, and thus more contacts are had with the schools of fish than was the cast with the sailing or auxiliary schooners Cleaning machinery enables the crew on board to take care of 5000 or 6000 pounds of fish in some 45 minutes Steam trawlers often land 300,000 pounds of cod, haddock, or halibut in a single trip, cleaned and iced ready for the market The increased production of fish has forced the fish dealers to seek more extended markets and also to extend the marketing over more months in the year A quick-freezing process has lately been devised by which the iced fish when landed at the docks are prepared for distant shipments or for storage which may last months. Marketing methods have been improved greatly.

The new type of fishing boat is still in the experimental stage A standardized type will undoubtedly soon evolve which will become as common as the trim schooners which have dominated the North Atlantic fishing banks for a century or so

Though the fishing industry declined, relative to other industries in the Northeastern States from 1850 to 1925, it is important to note that the business has never ceased to exist In fact it still plays an important part in the economy of the section With changes in national economic conditions, technical advances in the industry, and the substitution of fish for high-priced meat as food, there are reasons to expect a considerable revival of the fishing industry

QUESTIONS, EXERCISES, AND PROBLEMS

1 A successful fisherman is he who knows best the habits of fish What practical biological knowledge is essential to the cod fisherman? To the mackerel fisherman?

2 How have geologic forces and processes prepared the coastal districts and waters of New England and eastern Canada for the fisherman?

3 What advantages does the Chesapeake Bay region possess over the Maine coast for the oyster industry?

4 Make a list of species of fish that did not enter the industry in early New England fishing but that have become important in the catch since about 1930 Explain why this is true in each case

5 From the *Statistical Abstract* of the United States or other sources, get data to show the trend in cod fishing in the last decade Do the same for mackerel

CHAPTER 7

The North Central Section — An Inland Empire

Here in the interior of the continent lies a great domain with natural assets surpassing those of several of the principal nations of the world It is endowed with practically all the essentials for industrial sovereignty —a self-sustaining empire White man has occupied it only a very short time, but in that brief period he has brought it to a commanding position in the nation Politically he has divided it into a dozen states However, utilization of the natural resources has tended to develop common interests among those states—empire unity *What are its natural assets? To what extent has man utilized those assets? Has he made the best use of them? Does the region offer opportunities for further extensive development by man? Can it provide adequately for many more people?* In our consideration of these questions let us first examine the section as a whole and then by smaller units

A Great Plains Region Plains have always been important in the economy of man, and humid, temperate ones particularly so Such plains have been the great producing areas for most of the world's people, as they possessed a stimulating climate, and provided an abundance of well-watered, adequately heated, fertile lands, their low relief favored easy communication with all parts, many possessed rich deposits of the most useful minerals, and were accessible to the ocean The north central portion of the United States is part of the vast Great Central Plain which extends from the Gulf of Mexico to the Arctic and from the western to the eastern highlands Fully 1,250,000 square miles of this great inland plain is susceptible of high development The north central humid section of this plain in the United States, here being considered, is nearly as large as the combined area of the British Isles, France, Germany, Belgium, Netherlands, Denmark, Switzerland, Austria, and Czechoslovakia It now maintains less than a fifth as many people as there are in the countries named, though it rivals them in the natural assets within it, or tributary to it and unrestricted by artificial barriers such as political boundaries The whole section is of low relief (Fig 76), with only minor elevations here and there which offer no serious obstruction to intercourse throughout its extent The low relief, navigable rivers, Great

Lakes, and low passes through the eastern highland by way of the St Lawrence and Oneida-Mohawk Depressions permit access to the Atlantic—the world's chief commercial ocean Similar low relief and navigable rivers provide equally easy access to gateways at the south on the Gulf of Mexico These eastern and southern gateways are of special significance, since the eastern United States and Europe are the principal outside markets for the agricultural and other products of the central plains

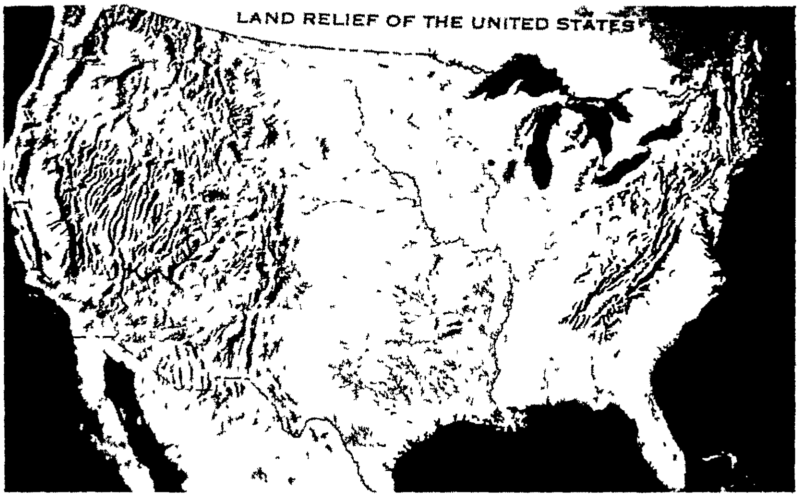

Fig 76 Between the lofty mountain and plateau area in the West and the comparatively low Appalachian Highland in the East lies a broad expanse of level to gently rolling plain, except where broken by the Ozark uplift *Courtesy, Bureau of Agricultural Economics*

A Propitious Climate. The climate is of even greater significance than the surface, soil, and gateways. It is of the continental type, with hot summers and cold winters but with precipitation sufficient for agricultural purposes Weather changes are frequent, due to the passage of cyclonic areas, and provide frequent showers. The rainfall decreases westward from 40 inches in eastern Ohio to 20 inches at the 100th meridian, but increases in the proportion that falls during the spring and early summer months, thus extending the productive area far westward. Throughout the entire North Central Section from 20 to more than 80 per cent occurs during the warmer half of the year when it is of greatest benefit to crops The diurnal distribution approximates the ideal since from 45 to more than 65 per cent of the warm-season precipitation occurs at night This increases the amount that enters the ground, reduces loss from evaporation, and provides for the maximum number of sunshine hours for crop growth The region is also favored with 50 to 70 per cent of the amount of sunshine possible (Fig 79) The growing season varies from 190 days in the south to 100 days in the north, favoring the growth of a great variety of agricultural products [1]

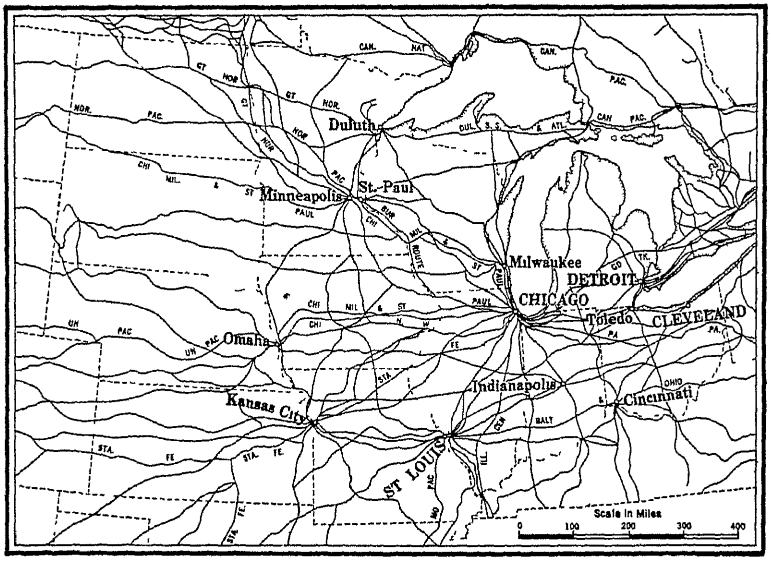

Fig 77 Principal railroads in the North Central States The railroad mileage in this group of states is more than two-fifths as large as that of Europe, and constitutes nearly two-fifths of the total in the United States

A Land With Copious Resources. The North Central Section offers greater opportunities as a home for man than any other region of the United States. Here are agricultural and grazing lands of the richest, here is power—coal, oil, natural gas, water, here are iron, copper, lead, zinc, cement-making materials, forests, here is a healthful, stimulating climate, here are the Great Lakes and America's great rivers, here is about 30 per cent of the population of the United States—a progressive, capable people maintaining a stable government, here is one of the world's most richly endowed areas—the making of a great inland empire Though a casual examination will reveal somewhat divergent physiographic, climatic, agricultural, and other industrial units, such as the Corn Belt, Spring-Wheat Area, etc , yet all are so closely related, so integrated, that common interests are being clearly recognized for the whole area and the evolution of sectional consciousness is in progress

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[1] For further discussion of climate, see Chapter 1.

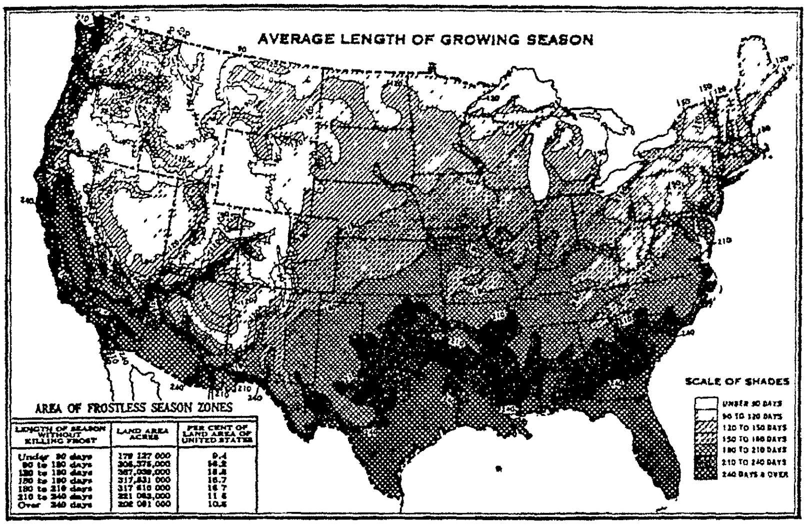
AVERAGE LENGTH OF GROWING SEASON
AREA OF FROSTLESS SEASON ZONES
LENGTH OF SEASON WITHOUT KILLING FROST
LAND AREA ACRES
PER CENT OF LAND AREA OF UNITED STATES
Under 90 days 179 127 000 9.4
90 to 120 days 306,375,000 16.2
120 to 150 days 357,039,000 18.8
150 to 180 days 317,831 000 16.7
180 to 210 days 317 810 000 16 7
210 to 240 days 221 083,000 11 6
Over 240 days 202 081 000 10.6
SCALE OF SHADES
UNDER 90 DAYS
90 TO 120 DAYS
120 TO 150 DAYS
150 TO 180 DAYS
180 TO 210 DAYS
210 TO 240 DAYS
240 DAYS & OVER
90
120
150
180
210
240

Fig 78 More than 90 per cent of the United States has a growing season longer than 90 days The season ranges from an all-year tropical condition in southern Florida to less than 90 days in the western highlands where high altitude and aridity favor rapid radiation at night The powerful influence of the mild westerly winds from the Pacific carries a growing season of more than 200 days northward along the coast through Washington, and the lesser influences of cyclonic winds from the Atlantic extend a similar growing season northward to Chesapeake Bay *Generalized from Atlas of American Agriculture, U S Department of Agriculture*

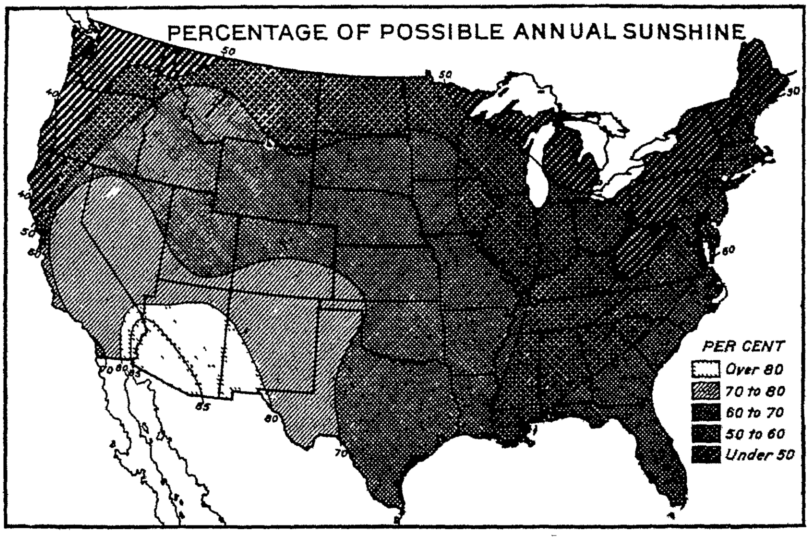

Fig 79. The principal agricultural regions of the United States receive from 50 to 70 per cent of the possible amount of sunshine (See Fig 14 for agricultural regions) *Courtesy, U S Department of Agriculture*

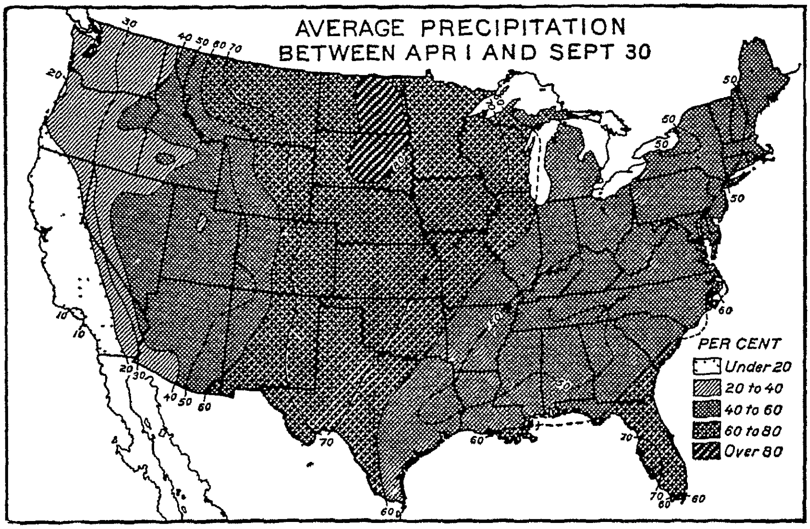

Fig 80 Where the total annual rainfall is small its seasonal distribution is of great importance Throughout most of the Great Plains region from 70 to more than 80 per cent occurs during the warmer half of the year when it is of greatest benefit to crops During the same period from 50 to more than 70 per cent occurs throughout the eastern agricultural region Compare with Figs 6–9 *Courtesy, U S Department of Agriculture*

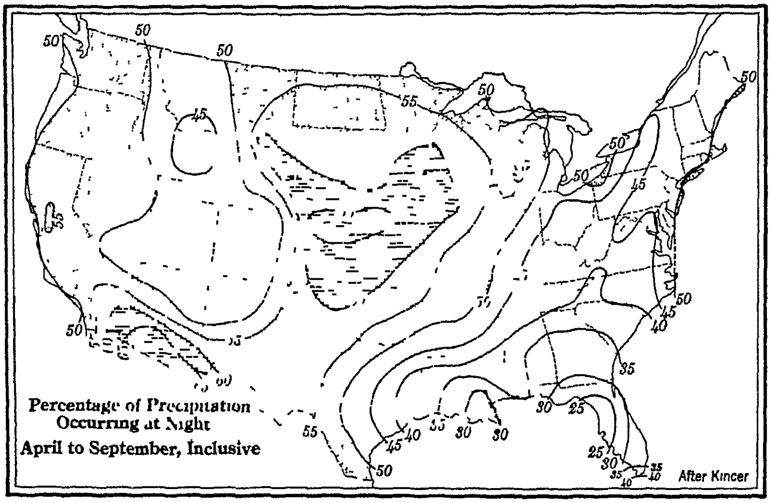

Fig 81 Ideally we would have rainfall occur in frequent, gentle showers at night during the growing season, and have abundant sunshine during the daylight period It is significant that 40 to more than 65 per cent of the total warm season precipitation occurs at night over principal agricultural regions of the United States Compare with Figs 6–9, and 78–81, and formulate a statement of the significance of the relations shown *After Kinser, Atlas of American Agriculture*

PHYSIOGRAPHIC REGIONS

Major Regions. Though the North Central Section is essentially a plain of low relief, the great variety of soils, the character of the old and new glaciated surfaces and the unglaciated areas, rocks of varying geological age, and small variations in relief produce divergencies sufficient to warrant the consideration in this discussion of at least two major physiographic regions—the Lake region and the Central Low Plains These regions may in turn be further subdivided when limited areas and greater details are considered *The boundaries, however, are zonal rather than lineal in most places* The regions of human use are not delimited by the physiographic boundaries, and the process of man's adjustment to what —at least theoretically—will be the most appropriate boundaries for selected types of activities is still in progress Conceivably, the time may come when man will find the activity that can best be carried on in each unit However, such an ideal adaptation is far in the future and will not be determined by physiographic features alone, nor are they likely to be the most important determinants (Fig 82)

The Lake Region. No marked topographic feature separates the Lake region from adjoining lands, yet this region is readily recognized as a physiographic unit. Its distinctive surface features are due to recent glaciation and are characterized by moraines, lacustrine plains, swamps, and thousands of lakes It was originally forested, and a large portion of the north is still occupied by native forests or cut-over lands, although most of the south has been cleared for agricultural purposes A southern extension of the Canadian Shield, a forested and slightly rugged mass of ancient rocks, projects into northeastern Minnesota, northern Wisconsin, and the upper peninsula of Michigan. These rock masses were somewhat subdued by glacial erosion and nowhere take on the character of mountains The chief resources of the Upper Lake Region are its forests, iron ore, and copper, which have been exploited extensively by man Agriculture on the cleared lands is slowly extending into the northern region but is dependent upon the lumbering and mining communities for a market Agriculturally, most of the Lake region lies in the Hay and Dairying Region, but the Corn Belt extends into the southern portion The southern portion also has most of the papulation and many large cities, and is one of the most important manufacturing and commercial sections of the United States. Much of the region's importance is due to the Great Lakes as well as to the great resources of minerals, forests, and soils, as few other areas of the world possess such superior opportunities for inland transportation In the early days the Great Lakes carried the explorer, fur trader, and settler in canoe or sailing craft, today steel vessels that rival the largest ocean freighters in size annually carry a freight tonnage more than three-fourths as great as the combined tonnage of Atlantic, Gulf, and Pacific ports of the United States The principal products carried are iron ore, coal, and grain Many commercial and industrial cities such as Chicago, Detroit, Cleveland, Buffalo, Toledo, Milwaukee, and Duluth have grown up along the lake shores

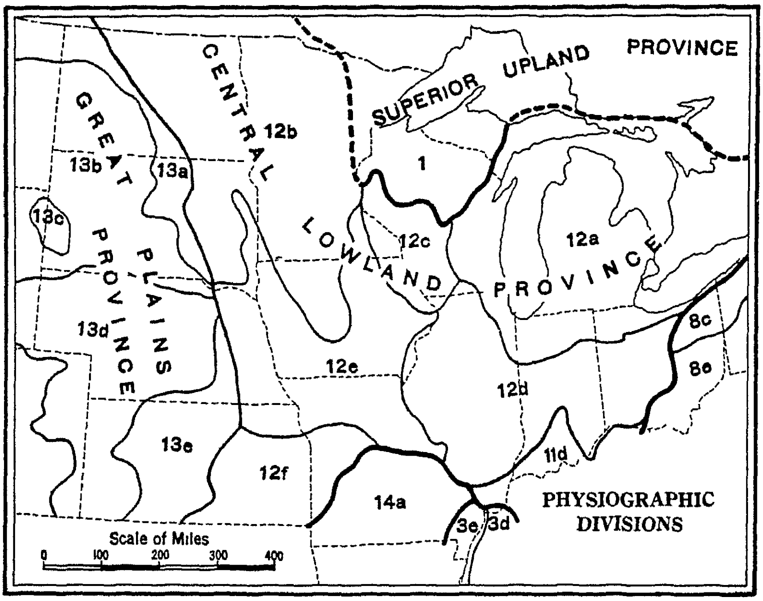

Fig 82 Physiographic provinces and sections of the north central states *After Feneman, Ann Assoc Am Geog , Vol VI* The sections are named as follows

3*d*	East Gulf Coastal Plain
3*e*	Mississippi Alluvial Plain
8*c*	Allegheny Plateau (glaciated)
8*e*	Allegheny Plateau (Conemaugh),
11*d*	Western (unnamed, but part of Interior Low Plateaus)
12*a*	Eastern Lake
12*b*	Western Lake
12*c*	Wisconsin Driftless
12*d*	Till Plains
12*e*	Dissected Till Plains
12*f*	Osage Plains
13*a*	Missouri Plateau (glaciated)
13*b*	Missouri Plateau (unglaciated)
13*c*	Black Hills
13*d*	High Plains
13*e*	Plains Border
14*a*	Springfield-Salem Plateaus

The Central Low Plains. This region of low plains extends south and west from the Lake Region and, as Dr Feneman has aptly stated, "is in the main bounded by lands which are either not low plains or not plains "[2] To the south and east are the Ozark Plateau and the western plateaus of the Appalachian system On the west the boundary is more indistinct, especially in Kansas and Nebraska Along the western boundary the glacial drift is thin, and loess is distributed over both glaciated and unglaciated lands To the west are the high, semiarid grazing lands of the Great Plains (or Plateau), and to the east the more humid, fertile prairies adapted to agriculture As the name implies, the surface of the region, as a whole, is gently undulating plain, though in a flat country low hills may become quite conspicuous features locally With the exception of limited areas such as the Driftless Area, essentially all the surface is covered by glacial drift older than that of the Lake Region. Upland lakes and swamps are rare, the moranic hills or ridges are comparatively low, and the slopes are gentle Though the region as a unit possesses great uniformity, the differences between glaciated and unglaciated areas, between recent and old glaciation, and between the work accomplished by altering agencies that toiled upon these surfaces through the thousands of years since glacial times afford a considerable variety of soils. These contrasts in relief and soil, together with native vegetation, afford bases for subdividing the region into, at least, the Forested Glacial Plains of Ohio, Indiana, and southern Illinois, which were originally timbered, and where the glacial surface is dissected into hills only along the streams, the Prairie Plains, a vast, native grassland country extending westward to the high Great Plains, and the Driftless Area of southwestern Wisconsin and adjoining states, with its poor, light soils derived from the underlying sandstone, and fertile clay loam soils derived from limestone

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[2] "Physiographic Boundaries within the United States," *Ann Assoc Am Geog* , 4, p. 109

The Driftless Area An area of about 15,000 square miles in southwestern Wisconsin, and extending into adjoining states, was not covered by ice at any time during the glacial period It is essentially a dissected plateau similar in many respects to west central Kentucky Along its morainal contact with the Lake Region, glacial outwash material fills many of the valleys, forming extensive plains above which rise numerous native rock hills resembling the buttes so common in the West Numerous picturesque cliffs, crags, pinnacles, and curiously formed "needles" and "chimney rocks," formed by caps of limestone on the easily eroded sandstone, are common and striking features There are also many sink holes and caves Weathering has produced a mantel of residual soil varying from sand, to sandy loam derived from sandstone, to clay-loam derived from the limestone. The sandstone-derived soils are poor, and the average value of farm land is about a fifth less than in the adjacent glaciated sandstone area Land values in the glaciated limestone area of Wisconsin are about twice those of the glaciated sandstone and two and a half times those of the unglaciated sandstone, the unglaciated limestones of the southwest have been so efficiently utilized for pasture, hay, forage, and dairying that land values are less than a tenth below those of the glaciated limestones The uplands of the Driftless Area in Minnesota carry a heavy cover of fertile loess and are highly productive

COHERENCE IN THE SECTION

The differences in soil and relief are not nearly so important in the major use that man has made of the section's resources as might be inferred from the contrasts drawn The "human-use regions" overlap and cross the physiographic regions indiscriminately Far more important is climate This is well shown in the present distribution of agricultural regions Most of the Corn Belt, much of the Corn and Winter-Wheat Belt, and essentially all of the Spring-Wheat Area, lie within the Central Low Plains, and their limits are not determined by physiographic features The major regions or subdivisions are not separated by marked features Neither are these independent economic units Instead they are distinctly interdependent, each having a variety of interests but specializing in one or more The leading product of one unit may find its chief market in another, or entirely outside the North Central Section For its successful development, each region depends quite as much upon the outside, as a market for its products and a source of goods not produced by it, as upon its own resources. Often a region produces only raw material that finds its market elsewhere, e g , the Spring-Wheat Region and the Lake Superior iron region (Upper Lake Region)

Together, the divisions of the North Central Section produce the essentials for sound economic development and a surplus to exchange for commodities produced elsewhere With coal, water, petroleum, and natural gas as power, much of the raw material is converted into finished products Within the region, many manufacturing, mining, and commercial centers are developing With this development is growing a more insistent political demand for cheaper outlets to the sea, such as the proposed Great Lakes-St Lawrence, and Lakes-to-Gulf canal projects The influence of the inland location is felt through the competition of the Panama Canal, which favors the eastern and western coasts, and through increased freight rates on railways

INDUSTRIAL DEVELOPMENT

Relative Position of North Central Section. In addition to its leading position in agriculture, the North Central Section is one of the most important manufacturing, commercial, and mining regions of the United

States (Table VIII) It possesses a remarkable combination of geographic and economic factors favorable to industrial development Its great extent of well-drained and fertile lands of low relief produces huge quantities of agricultural raw materials It has a healthful, stimulating climate, a great variety of metallic and non-metallic mineral resources—coal, iron, copper, lead, zinc, petroleum, natural gas, cement materials, building stone, salt, gypsum, clay, considerable water power, superior transportation facilities on the Great Lakes, thousands of miles of navigable rivers,[1] a close network of railways (Fig 77), and thousands of miles of

TABLE VIII

Comparative Industrial Position of the North Central States in Percentage of the United States

1 37 5 per cent of the net value of manufactured products
2 34 1 per cent of manufacturing employees
3 39 4 per cent (value) of power used in manufactures
4 6 0 per cent of lumber produced (board measure)
5 91 8 per cent (tons) of iron ore
6 46 1 per cent (tons) of pig iron
7 40 7 per cent (tons) of steel ingots and castings
8 49 1 per cent (net value) of flour and grain mill products
9 65 2 per cent (employees) of meat-packing products
10 3 8 per cent (tons) of copper
11 24 7 per cent (tons) of bituminous coal
12 45 0 per cent (tons) of lead
13 16 1 per cent (tons) of zinc
14 18 6 per cent (value) of all mineral products
15 46 1 per cent (tons) of salt
16 50 0 per cent (employees) of the 20 leading metropolitan manufacturing centers
17 22 0 per cent (employees) of petroleum refining
18 81 8 per cent (net value) of motor vehicles and parts
19 83 8 per cent (net value) of agricultural implements and tractors

highways that are being improved rapidly The section produces nearly two-fifths of the total product-value of manufactures of the country and uses more than one-third of the power employed in manufacturing, it produces one-fifth of the value of all mineral products, more than four-fifths of the iron ore, one-tenth of the copper, about one-fourth of the lead and zinc, more than half the salt, nearly two-fifths of the clay products, and more than two-fifths of the pig iron and steel Utilization of its varied mineral resources and farm products has resulted in a rapid and extensive development of manufacturing and commerce, and the growth of many industrial centers, especially along the shores of the Great Lakes, or at focus points on its navigable rivers It now has 14 of the 25 leading manufacturing cities, and both Buffalo and Pittsburgh, located just outside the area, owe much of their industrial growth to the development of the North Central Section

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[1] Little used at present, but of high potential value

Natural Resources Affect Civic Attitude The varied economic resources and consequent diversity of human interests have long shown their influence in a lack of unity in politics in contrast with the unity of New England In the past, political leaders have been unable to agree among themselves as they represented people engaged in diverse occupations On the one hand are the manufacturing and commercial interests inclusive of the wage-earner who depends upon them, and on the other the agricultural interests Today the farmer is both a laborer and a capatalist, and modern financing methods have led all groups to invest their funds in a great variety of enterprises Though mercenary group interests still dominate, yet out of these conditions is slowly arising a realization that the interests of all human activity groups are closely integrated, and that the success of one depends upon similar success of the others Neither the farmers nor the dweller in the densely populated city can prosper without the other Practical attainment of such a unity concept will go far toward the most effective development of the section and of the country as a whole

PROBLEMS

1 Can the North Central States maintain a population as large as that now maintained on any equal contiguous area in Europe?

2 Can the North Central States ever equal the North Atlantic States in material development?

3 Will manufacturing become of greater importance than agriculture in the North Central States?

4 To what extent do physiographic regions influence man's activities?

5 Can the handicap imposed by an inland location be overcome?

CHAPTER 8

Agriculture in the North Central Section

Agriculture the Leading Industry Agriculture is the most widespread and the leading industry, though more people are engaged in the numerous other industries and professions carried on in the region Three-fifths of the population at the last census was classed as urban The rural population declined from 61 4 per cent in 1900 to 39 1 per cent in 1950; the actual *farm* population is probably slightly more than half the percentage classed as rural by census reports This decline is, undoubtedly, continuing From the standpoint of the farmer, the decrease is economically desirable as it increases his market in the centers where manufacturing, commerce, and mining are developing. With large farms and the use of machinery, to which the surface of the region is excellently adapted, he will be able to produce sufficient food to meet all demands for considerable time to come

Agriculture is now more fully developed in the North Central Section than in any other portion of the country. The broad expanse of arable land is well tilled, there are extensive improvements, and the average returns are relatively high. About four-fifths of the land area of the North Central Section is in farms A large part of the present unimproved land is capable of producing crops or pasture and now constitutes a reserve. The section has nearly half the total value of farms and buildings and of automobiles and trucks on farms, one-third of the farms with running water, nearly three-fifths of those with telephones, two-fifths of those with electricity, in the United States Seven-tenths of its farms are operated by owners and part owners This section produces more than nine-tenths of the soybeans, nearly three-fifths of the wheat, four-fifths of the corn, nearly seven-tenths of the swine, three-fifths of all livestock, and similar ratios of other products. Farms have been increasing in size and now average about 200 acres each. More than 100,000 exceed 500 acres Table IX illustrates the relative agricultural importance of the north central section, the preeminent food-producing region of the United States No other agricultural region of the world equals it in production or in the economic well-being of its farm people (Fig. 83)

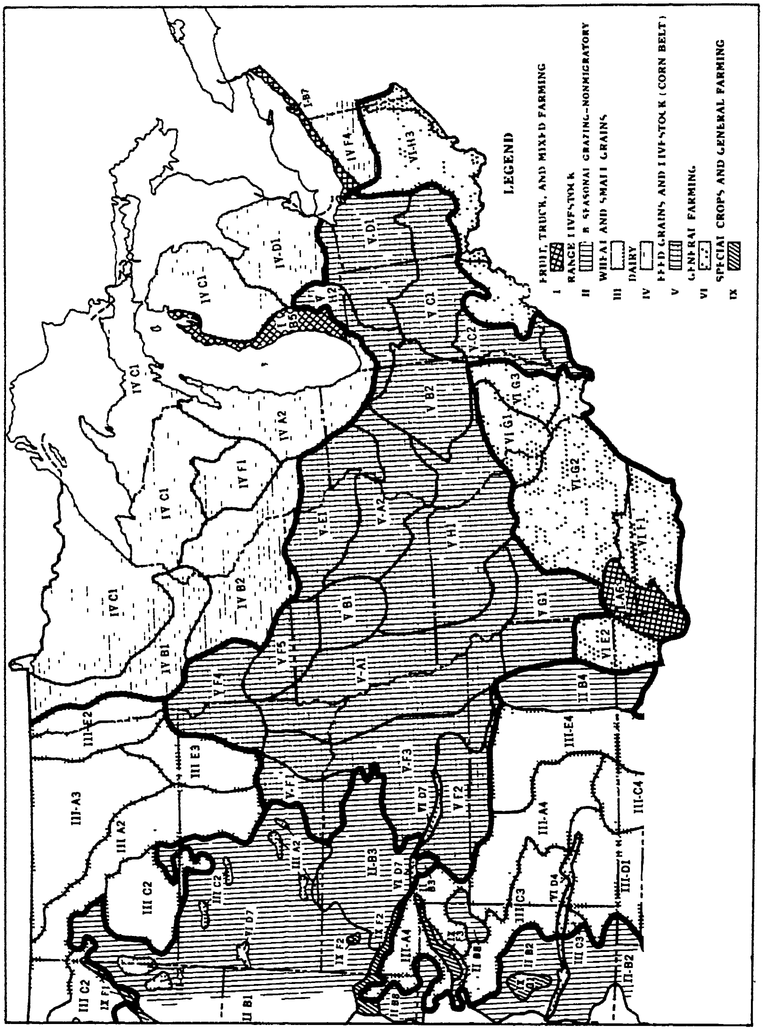
LEGEND
I FRUIT, TRUCK, AND MIXED FARMING
II RANGE LIVESTOCK
B SEASONAL GRAZING–NONMIGRATORY
III WHEAT AND SMALL GRAINS
IV DAIRY
V FEED GRAINS AND LIVESTOCK (CORN BELT)
VI GENERAL FARMING
IX SPECIAL CROPS AND GENERAL FARMING
IV C1
IV B1
IV B2
IV F1
IV A2
IV D1
IV F4
VI H3
V D1
V C1
V C2
V B2
VI G1
VI G2
VI G3
VI F1
I A6
VI E2
II B4
V E1
V A2
V H1
V B1
V F5
V A1
V F4
III E2
III E3
III E4
III A3
III A2
III C2
V F1
V F3
V F2
VI D7
II B3
II B1
IX F2
IX F1
III A4
III C4
III C3
VI D4
III D1
II B2
I B5
I B7

Fig. 83. Types of farming in the North Central Section Agricultural enterprises in the subregions are significant, in addition to the dominant enterprises of the major region. *Courtesy, Bureau of Agricultural Economics*

I-*A*6. Fruit, poultry, and dairy.
I-*B*5. Fruit, truck, dairy, and poultry.
I-*B*7. Fruit, truck crops, and dairy.
II-*B*1,2,3,4,8. Seasonal grazing—non-migratory
III-*A*2,3,4. Specialized wheat.
III-*C*2,3,4. Wheat and range livestock.
III-*D*1 Wheat, grain sorghums, and range livestock.
III-*E*2,3,4. Wheat and general farming.
IV-*A*2. Specialized dairy.
IV-*B*1,2. Dairy and livestock.
IV-*C*1. Dairy, hay, and potatoes.
IV-*D*1. Dairy and cash crops.
IV-*F*1,4. Dairy and general farming.
V-*A*1,2. Cattle feeding and hogs.
V-*B*1,2. Cash corn, oats, and soybeans.
V-*C*1, 2. Hogs and soft winter wheat.
V-*D*1. Livestock, dairy, soybeans, and cash grain.
V-*E*1. Hogs and dairy.
V-*F*1,2,3,4,5. Livestock and cash grain.
V-*G*1. Livestock, cash grain, and dairy.
V-*H*1,2. Livestock and pasture.
VI-*D*4,7. Livestock and special crops—irrigated.
VI-*E*2. Livestock and cash grain.
VI-*F*1. Livestock, truck, and cotton—small-scale.
VI-*G*1,2,3. Dairy, livestock, and poultry
VI-*H*3 Livestock and tobacco.
IX-*F*1,2,3. Sugar beets, dry beans, and livestock—irrigated
IX-*G*1. Dry beans—non-irrigated.

The process of crop adjustment to physical and economic conditions is never completed because all the influencing factors are variables. In attaining the present stage of land use, man has been influenced profoundly by the natural setting in which he was placed. As Elliott has so aptly stated, the "tendency of farmers to adjust their organizations and practices to their environmental conditions is merely an attempt, on their part, to get a maximum utilization of the resources at their command. They are consciously or unconsciously seeking to economize on their resources by producing those commodities which will give them a maximum of return for the resources used. In doing so, they necessarily depend upon obtaining from others commodities and services which they themselves are at a comparative disadvantage in producing. The inevitable consequence of such a development is that farmers in different regions will follow different lines of production."[1] The same basic principle of human occupance of the land and maximum utilization of the resources has been set forth lucidly by Holmes: "Each region tends to utilize its productive resources by producing those commodities from which it will realize a maximum of value for the resources used and to exchange these products for those in which its productive advantage is comparatively less, drawing these latter products from regions in which their production means maximum utilization of resources."[2] Since land resources and economic conditions vary widely in the North Central Section there is a similar wide variation in the use made of the land. As a result we have cash-grain regions such as the Spring-Wheat and Winter-Wheat Regions, the Corn Belt, Dairy Region, etc.

Premier geographic conditions have made possible a rapid and extensive agricultural development, such as the great expanse of level land suited to large-scale use of labor-saving machinery, manifold variety of soils of high average fertility, abundant summer rains falling in frequent gentle showers, high summer temperatures and long growing season, a stimulating and healthful climate in which to live, excellent home markets in the rapidly growing urban centers, access to eastern and to foreign markets, and superior transportation and marketing facilities.

Leading Crops. A great variety of crops are now produced, but the fertile soils, large expanse of level land, labor supply, and available markets favor extensive rather than intensive agriculture. The temperature and rainfall are highly favorable to wheat throughout the entire section, and to corn, in the central and southern parts. Though the section is dominantly a cereal country, most of the farm area is devoted to production of feed and livestock and to dairying (Fig. 83). Farm animals occupy a prominent position in the agricultural economy practiced in the North Central Section. The wheat areas in such states as Michigan, Illinois, Wisconsin, and Minnesota have decreased, and production of stock feed and dairying have come in. The leading crops of the section are corn, wheat, hay and forage, soybeans, and oats. Other important crops include rye, barley, potatoes, flax, fruits, sugar beets. As shown in Table IX, a large share of the leading crops of the United States is produced in this section.

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[1] F. F. Elliott, "Types of Farming in the United States," U. S. Dept. of Agr., 1933, p. 1.

[2] C. L. Holmes, "Economics of Farm Organization and Management," U. S. Dept. of Agr., p. 47.

TABLE IX

COMPARATIVE AGRICULTURAL POSITION OF THE NORTH CENTRAL SECTION IN PERCENTAGE OF UNITED STATES

1. 82.6 per cent of total land area is in farms.
2. 198 acres average size of farm.
3. 47.5 per cent of total value of farms and buildings.
4. 51.7 per cent of total value of farm machinery.
5. 35.2 per cent of all farms operated by owners and part owners.
6. 43.2 per cent of all automobiles and trucks on farms.
7. 58.0 per cent of all tractors on farms.
8. 57.6 per cent of all farms with telephones.
9. 40.0 per cent of all farms with electricity.
10. 57.6 per cent of all wheat (bushels) produced.
11. 79.0 per cent of all corn (bushels) produced.
12. 46.8 per cent of all hay (tons) produced.
13. 49.0 per cent of total value of all livestock on farms.
14. 39.1 per cent of population is rural.
15. 60.0 per cent of all dairy and livestock farms.
16. 33.1 per cent of all farms with running water.
17. 31.6 per cent of farm population.
18. 81.6 per cent of all oats (bushels) produced.
19. 93.7 per cent of all soybeans (bushels) produced.
20. 41.5 per cent of all cattle (number).
21. 68.7 per cent of all swine (number).
22. 70.0 per cent of its farms are operated by owners and part owners.

WHEAT

Wheat, the Principal Food Crop. There are two major wheat regions, spring wheat at the north and winter wheat farther south. Between these two great wheat-producing areas and overlapping into each is the Corn Belt. Out of an annual wheat production of 1,250,000,000 bushels in the United States, 750 million come from this section. It has been estimated that 5 to 6 billion bushels of wheat are required annually to feed the wheat-eating population of the world. On this basis the North Central States produce 12–15 per cent of the world's requirements, making this section one of the world's great producers of high-quality foods.

The Red River Valley. The Red River Valley, celebrated for its high-quality wheat, is the heart of the spring-wheat region. Throughout this region, extending westward from central Minnesota into North Dakota and northward into Canada, the traveler is confronted by mile upon mile of almost level plains carrying a fertile, heavy, black clay-loam soil. Highways, straight as an arrow for many miles, lead off toward the horizon and apparently fade out to infinity. Here and there a group of trees, forming a windbreak about a farm home, or a ribbon of foliage along a stream breaks the view. During the harvest season of the late summer, thousands of acres of golden-colored grain, falling before the battery of modern harvesting machines, confront the eye. Still later, the night sky is lighted by dozens of burning straw piles that send up their flames like beacons on a seemingly endless plain. This is the land that produces the high-grade, hard, spring wheat. However, the spring-wheat region is not confined to the Red River Valley proper. It extends to the southern bend of the Minnesota River in Minnesota, south to the Missouri in South Dakota, and westward to the high plains of northwestern North Dakota, where it is limited by scant rainfall. This region produces more than three-fourths of the spring wheat of the United States (Fig. 84).

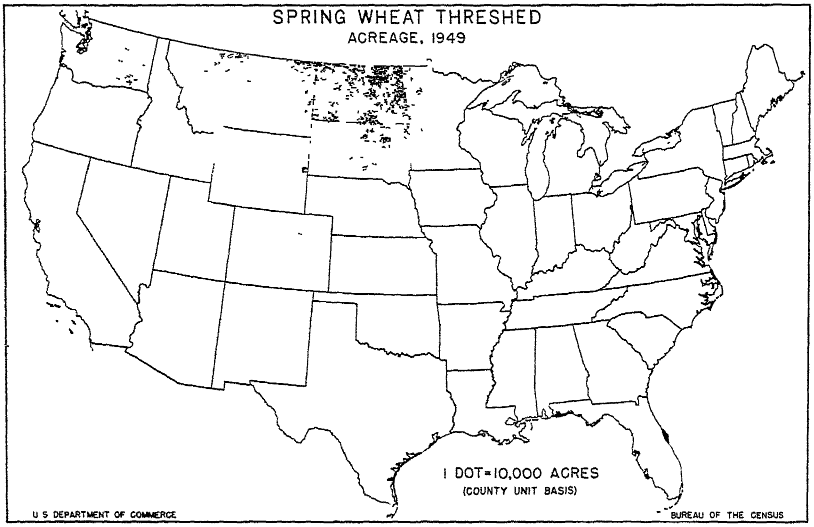

Fig. 84. The Spring-Wheat Region.

Conditions are almost ideal for the growth of a superior grade of breadmaking wheat. Most of the region is covered by glacial soils or by lacustrine deposits of fine black soils varying from clay loams to heavy, black, sticky clay, or "gumbo" (Fig. 12). Most important, however, is climate. The ideal conditions for wheat are commonly considered to be a long, cool, wet spring, favoring "tillering," followed by a warm, sunny, dry harvest period. The climatic conditions are almost ideal. Most of the rain comes in spring and early summer, followed by a dry and sunny fall for the maturing and harvesting of the grain. The dry, warm, ripening period is largely responsible for the large, glossy kernel, rich in nitrogen and protein, that makes the product of this region a choice flour wheat superior to the softer grains grown in cooler and moister areas. Approximately half the rain comes from March to June, and much of the winter snow melts and enters the ground, thus providing the moisture needed early in the spring. The western limit of spring wheat is practically the mean annual rainfall line of 15 inches.

For many years, wheat has been the dominant crop. It is well known that the practice of growing one kind of crop year after year will ultimately cease to yield a profit. Yet it is difficult to bring about a change. A change from a single crop to mixed farming is much easier in sections east and south where rainfall is more abundant and the growing season longer. However, in a region having a short growing season with a small margin of rainfall safety, and located long distances from market, such a change is difficult, and is commonly accompanied by much economic distress which is reflected frequently in political dissatisfaction. There is a human tendency to cling to what has been tried, especially when the chief money crop is involved. The tendency to look to the government for the solution of geographic and economic problems is a natural result. This was illustrated by the rise of the Non-Partisan League in North Dakota and its extension to adjoining states, as Minnesota and South Dakota, and by a coalition with labor and the Democrtic Party. The astuteness of the political leader who can capitalize this discontent, offer a panacea, make this combination between the capitalist-farmer and urban laborer, and be elected to office must at least command respect. This mental state is not difficult to understand, considering the high freight rates to distant markets, and a high price for commodities purchased. With a small margin of safety in rainfall, a decrease of a few inches during the growing season means a large crop loss, more economic distress and more political determination.

Wheat, and still more wheat, remains the dominant idea. With 30–60 per cent of the crop acreage devoted to its culture, prosperity waxes and wanes with the yield and price. This is reflected in the sale of new machinery, automobiles, clothing, groceries, and the whole gamut of produce needed by the farmer. Yet, as previously noted, a change is slowly taking place. The problem of selecting suitable crops for diversification is difficult. Hay and other forage crops (such as corn) and potatoes are being tried northward into the moister parts of the Red River Valley. The drier portions in the West are still in the agony of being reborn, and a possible new life may be found in a decrease of wheat acreage and a partial return to forage crops and livestock.

The Land of Winter Wheat. Winter wheat, unlike spring wheat, is sown in the fall and attains a substantial growth during that season. It readily survives the cold of a moderate winter, especially where amply covered with snow. During the cool of early spring, it tillers more abundantly than spring wheat and sends forth many stalks, each of which bears a head of grain, hence the yield is larger than that of spring wheat. The harvest season comes in June and early July and requires the importation of much labor. A floating class of laborers handles much of the wheat during the harvest season. These laborers, together with their harvesting machinery, start their trek in Texas and Oklahoma and move northward into Kansas, the Dakotas, and Canada as the harvest season advances.

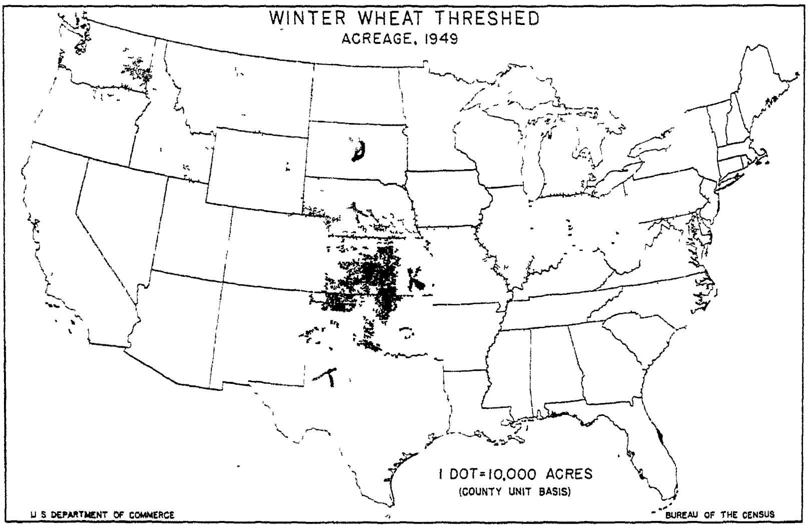

Fig. 85. Most of the winter wheat is grown in the Hard Winter-Wheat Region, the Corn and Winter-Wheat Belt, and the Corn Belt. The southern boundary follows closely the isotherm of 72° for the month preceding harvest (June 15). Wheat grown south of this line is subject to severe damage from rust. The northern boundary follows, in general, the mean winter isotherm of 20°.

The principal producing area (Fig. 85) is central Kansas, extending northward into Nebraska and southward into Oklahoma. This area produces the high-grade, hard winter variety. A minor winter-wheat area, producing softer wheat, extends through Illinois, Indiana, southern Michigan, Ohio, Pennsylvania, Maryland, and Delaware. The limits of the region of densest production are determined by climate rather than by surface or soil. The climate is not the best in the world for wheat, but wheat is the most profitable crop to grow in such a climate. The region of greatest production has a rainfall of 15–30 inches and a growing season of 150–220 days. The northern boundary is essentially the mean winter temperature line of 20° which extends from southern Wisconsin across northern Iowa and northwestward across North Dakota and Montana. Very little winter wheat is grown north of this line, yet the larger yield that may be obtained has led a number of Minnesota and Dakota farmers to "take a chance" on winter wheat. There appears to be an increasing number who are taking that "chance," and consequently winter wheat is spreading into the southern part of what has long been known as the spring-wheat region. Beyond the western boundary, which is determined by low rainfall, better returns may be obtained by utilizing the grasslands for pasture. The eastern limit is determined by heavier rainfall, which makes corn and livestock production more profitable. Toward the south, where high temperature and high humidity and rainfall stimulate fungus diseases of wheat, where the soils are more leached than in the north, and where a rainy harvest is very unfavorable, wheat comes into competition with cotton.

Winter wheat constitutes more than three-fourths of the total wheat crop of the United States. More than half the winter wheat comes from the north central section, mostly from the Kansas-Nebraska-Oklahoma hard-wheat area. Few states east of the Mississippi River produce more wheat than they consume, and their surplus is not nearly equal to the consumption east of the river. Some of their wheat is exported, and other wheat is brought in from the West to meet the requirements. Winter wheat, as a whole, is now on an export basis, and since the United States produces a surplus for the markets of the world, marketing of this surplus brings into relief the influence of inland location and transportation rates.

Wheat is a cash crop, and the dominant one in the hard-winter-wheat-producing area. Here the farmer depends almost entirely upon it for his money income. In central Kansas, from 60 to more than 80 per cent of the crop acreage produces wheat, and three-fourths of the farmers of that state grow the crop. Other products—oats, corn, rye, butter, eggs—are produced for home consumption. Hence, here as in the spring-wheat region, prosperity is governed by the returns upon the wheat crop.

The wheat farmer of the Kansas-Nebraska-Oklahoma area who considers the future and contemplates diversification is confronted with the problem of finding suitable rotating crops. The number available is distinctly limited by the small rainfall. His substitutes are forage crops—hay, millet, corn, kafir, milo, and other sorghums, etc.—hence the raising of livestock. Though non-geographic factors, such as rail and water freight rates, tariffs, and increased wheat consumption may direct his efforts in coming years, it seems likely that the wheat acreage will be decreased somewhat and forage crops and livestock increased relatively. The farms are also likely to remain large, as the level land is favorable to the use of machinery, and the small rainfall limits the crops to comparatively low yields an acre. Limited as it is by climate, the area is likely to continue to be a producer of wheat for bread and livestock for meat.

UNIT AREAS IN THE WHEAT REGION

Studies of several small unit areas, even though such studies are in the nature of an "overview," aid in amplifying the more generalized treatment. Since a brief discussion of any large region must be on broad lines, many details that show the intimate adjustments of man to the land are necessarily omitted. However, it is the sum of these detailed relationships that characterize the whole. Numerous reasons may determine the selection of such unit areas for study, e.g., because they are representative of a much larger area; because they represent the highest type of all-round development; because they typify the growth of a selected industry; because they represent the evolution of an urban or a rural community. The unit areas discussed in succeeding pages have been selected from widely separated parts of the north central section as representative of (1) rural and (2) rural-urban communities in which one or more phases of human interests predominate. However, none of these areas possesses outstanding leadership in any particular field of human endeavor. In this respect each is typical rather than exceptional. Essentially the same form of organization has been followed in the discussion of each unit so as to facilitate comparisons.

TRAILL COUNTY, NORTH DAKOTA[3]

The Red River Valley has long been famous for its fertile soils and high-quality spring wheat. Traill County, North Dakota, bordering the Red River of the North and lying midway between Fargo and Grand Forks, is a representative section. All of the county, except a few square miles of glacial moraine, lies within the limits of glacial Lake Agassiz.

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[3] See a more detailed study of the Red River Valley by J. R. Schwendeman in *Economic Geography*, July and Oct., 1944; Jan. and Oct., 1945.

The northwestern two-thirds is covered by a glacial river delta which was formed in Lake Agassiz and which has a gently sloping, level-to-slightly-ridgy topography. The lower lake bed to the east is nearly flat and is poorly drained. Numerous ditches have been excavated to carry off the excess water during wet seasons. The area as a whole presents a very flat to gently undulating prairie landscape broken only by groves of trees forming windbreaks about the farm homes, or a narrow belt along some of the streams. The soils are of lacustrine, glacial, or alluvial origin. The lacustrine deposits, which cover most of the region, consist chiefly of fine silt and clay-loam derived from glacial till, laid down in the quiet waters of Lake Agassiz and later weathered under very deficient drainage conditions. They carry a high percentage of humus and are dark-colored to black.

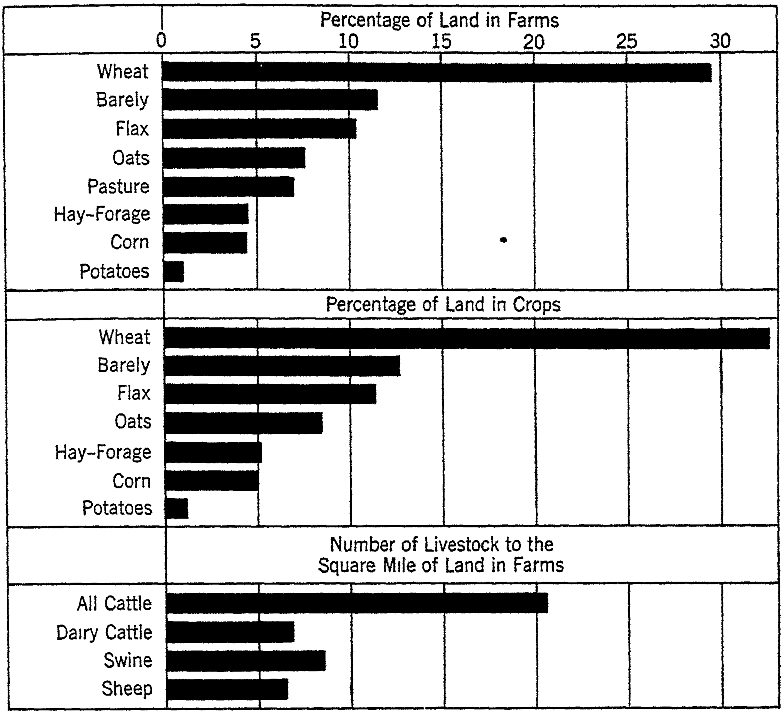

Fig. 86. Land utilization in Trail County, North Dakota.

The winters are long and cold (average 8°) and the summers are cool (average 66°) but have a growing season of 130 days and sufficiently hot periods to be very favorable to the growth of hardy cereals. Extremes of temperature occur, but usually last for only short periods. The highest recorded temperature is 108° and the extreme minimum −41°. The autumn is commonly dry, with many weeks of warm mild weather, making fall plowing possible until the middle of November, when the cold of winter frequently arrives with a sudden cold wave which freezes the ground and stops all further plowing until spring. The area has a subhumid type of climate with a mean annual rainfall of 22 inches, two-thirds of which falls in the spring and summer months. However, the rainfall varies considerably from year to year with wet and dry seasons occurring in more or less well-defined cycles. Low rainfall in some years and excessive rain in others may cause serious crop losses. The heavy rains are particularly serious on the lower, nearly flat, and poorly drained lake-bottom lands.

The area was among the earliest settled parts of the state. Most of the early settlers were of Scandinavian and German nationality, from Minnesota, Wisconsin, and Iowa. They found the country a region of rolling open prairie and settled along the larger streams which afford means of transportation in the summer, where timber for fuel and building purposes was available, and where there was a water supply. In winter the grain crop was hauled overland to Fargo where supplies were obtained, and in spring and summer travel followed the river routes. Before railroads penetrated the region, the settlements were close to the rivers and most traffic was by boat, especially on the Red River of the North. With the building of railroads in the 1880's, dependence upon the streams for transportation ceased and settlement soon spread to all parts of the region. The population in 1950 was 11,300, which represents a decline since 1940. Two cities, Hillsboro and Mayville, are about equal in size and have a combined population of 3100. The balance of the people—nearly eight-tenths—live on farms and in a few small villages. All urban centers are based on serving the farm community. The farm population has declined to an average of about 6 to the square mile of farm land.

The towns serve as local purchasing centers and as shipping points. In addition, there are numerous sidetracks with grain elevators and other facilities for shipping farm products. No farm is more than 6 miles, and most farms are within 3 or 4 miles, of some railroad point from which products may be shipped to market, and the area has good highways to market.

A Land of Agriculture Only. Agriculture is the one great industry of the region, and for many years it was of a one-crop type. The rich soils and the climatic conditions were recognized by the early settlers as being highly favorable to the growth of small, hardy grains. Spring wheat has always been the leading crop, and nearly 14,000 acres were devoted to it as early as 1880. Ten years later it occupied half of all the land in farms, and the maximum acreage was reached in 1900. Since then it has declined in relative importance and in 1950 a little less than a third of the crop land was devoted to it. This decline in wheat acreage was accompanied by (1) an increase in the percentage of farm land devoted to oats, barley, rye, corn, cultivated hay and forage crops, and pasture, and (2) an increase in the number of livestock maintained (Fig. 86). This was a trend toward greater diversification, a trend that is still in progress. The continuous growth of wheat on the same land results in decreased yield and an excessive growth of weeds. Though 30-40 bushels an acre may be produced in favorable years, the average is about 13 bushels. Conditions have fostered crop rotation and the use of crops, like corn, the cultivation of which reduces the growth of weeds and yields a profitable return for the season in contrast with summer fallowing. With this change is coming the production and fattening of more cattle. However, grain growing still dominates and livestock is of relatively minor importance, though there are now about 17 domestic animals, other than horses and poultry, to the square mile of farm land. The number of horses is declining and that of poultry is increasing.

The wheat lands are usually plowed in the early fall, tractors pulling from two to eight plows being used extensively. Harrowing or disking is done in the early spring, and the seed is sown from April 1 to May 10. Harvesting time is a very busy season and it was a common sight on the larger farms to see five or more binders following each other around the field, each cutting a swath of 7 or 8 feet. The grain was usually shocked and threshed from the field, and the straw burned to get it out of the way. Today the combine is displacing the more picturesque harvesting scene. Many operators of the larger farms maintain their own threshing outfits, but threshing on the smaller farms is done by outfits that go from farm to farm. Most of the wheat and other surplus grain is marketed in Minneapolis and Duluth.

Barley now ranks next to wheat, with 12 per cent of the cropped land devoted to it. Flax is a close second, with oats, hay and forage, and corn, ranking next in order. The short growing season is not favorable for production of corn for grain, and it is grown almost entirely for fodder. In that form more efficient use can be made of the unmatured crop.

Oats are a very important stock feed, and much of the crop is an early maturing type—60-day oats—which ripens before the hot, dry weather prevalent in the last half of July. Barley has been grown for stock feed ever since the days of early settlement.

Flax became an important crop in the nineties for sod-breaking purposes, as the sale of seed yielded an income the first year. It is still grown to break the stiff alfalfa, clover, and timothy sod and is likely to remain in the agricultural system as hay crops are becoming established as part of the rotation scheme. Other important crops include rye, potatoes, grass seeds, especially clover and alfalfa, sweet clover for pasture, emmer, spelt, and small fruits. About 5500 acres produce potatoes. They are grown throughout the area for home consumption and in numerous parts on a commercial scale. One of the most important potato centers is about Hillsboro, near the south central part of the county, where there are large storage warehouses and good shipping facilities. The best-quality potatoes and the largest yields are obtained on the sandier soils, but the crop is grown on all kinds of soil.

Though the livestock industry is relatively unimportant, it is receiving greater attention each year, and increasing numbers of animals, especially cattle, sheep, and swine, are being raised and fattened for market. Seven per cent of the farm land is used for pasture.

Summary. The development of the area has been rapid, its present economic condition having been attained in a little more than half a century. In the eighties the best land could be purchased for $8–10 an acre. In 1950 the average value was $66 an acre, including buildings, with considerably higher values for well-improved farms located near good shipping centers. In the same year the value of land, and buildings, averaged $26,000 a farm. Today the region has the appearance of a well-settled farm community with good farm buildings and houses well protected by windbreaks with 64 per cent of the farm land operated by owners and part owners. More than one-tenth of the farm homes have running water, two-fifths electric service, nearly three-fifths have telephones, nearly nine-tenths have radios, and there are more automobiles than farms. For many years the great wheat farms were very large, but they are now being broken up into smaller units. Though there are still some farms containing more than 1000 acres the average size is now 380 acres. Most of the farms are small enough to be operated by the farmer and his family, with hired labor during only a part of the year. The early one-crop system of farming is giving way to diversification, and wheat is becoming relatively less important.

WESTERN MARGIN OF HUMID SECTION

Central Kansas is on the eastern margin of the semiarid Great Plains and the western margin of the humid section of the North Central States. It is also in the Hard Winter-Wheat Region. Reno County, located in the south central part of the state, may be taken as representative of this marginal belt (Fig. 87). Three-fifths of its crop acreage is devoted to hard winter wheat; in the counties on the west of it the proportion is 63–76 per cent, and in those on the east 13–48 per cent.

The first settlers arrived in the early 1870's and were homesteaders, principally from the middle western states. As a result of this method of acquiring land, most of the farms originally contained 160 acres. In more recent years the tendency has been toward larger farms or the renting of large areas in addition to the farmer's own holdings. At the 1950 census the farms averaged 271 acres, but there were several that contained 1000 or more acres. More than three-fifths of the cropland is operated by owners and part owners. In the early days the grasshopper pest and a number of seasons with deficient rainfall and consequent low crop yield checked settlement, but, on the whole, development has progressed steadily since the advent of railroads. Today there is a farm home on nearly every quarter-section except in the sand-hill and Red Bed sections where the soil is poor and the population is sparse. As in most other agricultural regions, the farm and the small village population has declined while city population has increased. The largest beneficiary has been the city of Hutchinson, which now has 60 per cent of the total population of the county. The attraction of a year-round job in the city together with greater social and educational advantages, and the extensive use of machinery in large-scale farming are probably major factors in the move-

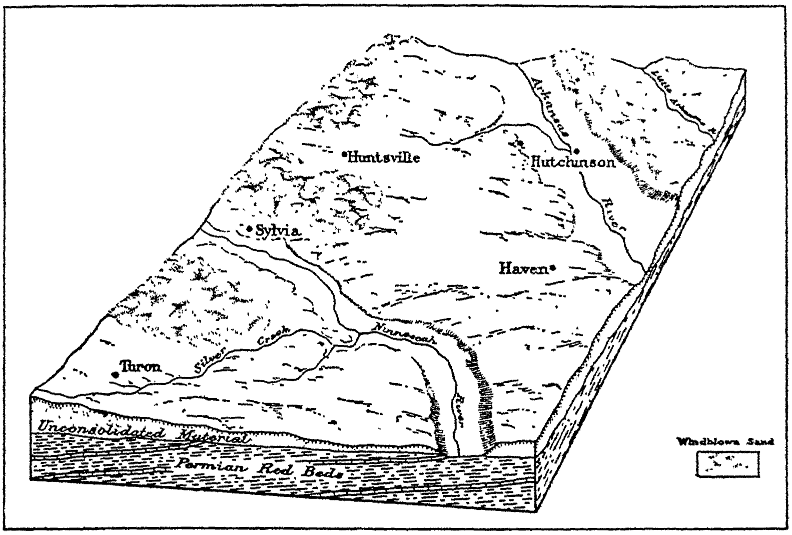

Fig. 87. Diagrammatic map showing the surface features of Reno County, Kansas. *Courtesy, U. S. Bureau of Soils.*

ment. The present farm population averages about 12 to the square mile, and, under the prevailing conditions of climate, soil, and general economy, there is little indication that this average will increase materially in the immediate future.

Surface and Soils. Physiographically, the area is in the Great Plains. Its gently undulating surface slopes very uniformly downward toward the east and is intersected by three relatively narrow and shallow valleys. The present local elevation differences are due primarily to wind action and stream erosion. The maximum range in elevation is only about 400 feet, and this is due in large part to the general westward rise common to the Great Plains. The area contains four physiographic regions which differ in their adaptability to agricultural uses, viz., (1) the prairies, (2) the Arkansas River Valley, (3) the valleys of the Ninnescah and Little Arkansas Rivers, and (4) the sand hills or dune areas. In general, the soils are brown in color and residual, alluvial, or aeolian in origin.

The prairie region occupies most of the county and has a gently undulating surface with broad, gently sloping ridges that rise scarcely 20 feet above the adjacent depressions. It has numerous low-gradient, short, intermittent streams that flow in indistinct valleys. Along the western margin are areas of sandy, dunelike hills. The soils over most of the high prairies vary from silty loam to clay-loam and are somewhat heavy. They are best adapted to small grains, especially wheat. They are also good corn lands, but are not so good in dry years as the sandy loams. The principal crops in the prairie region include wheat, sorghum, oats, hay, corn. More than 85 per cent of the hay-producing land grows alfalfa, and some 9000 acres produce clover seed.

The Arkansas Valley bisects the northeastern quarter of the area (Fig. 87) and is a broad, shallow trench. It is 5-10 miles wide and 10-50 feet below the upland, but in places the valley and prairie blend so completely that there is scarcely any line of demarcation. The city of Hutchinson is situated in this valley trench, with South Hutchinson just across the river. The flat-bottomed valley is occupied to a depth of 100 feet or more by alluvial sand, gravel, and clay carried from the Great Plains and Rocky Mountains. These materials are good retainers of moisture absorbed from the winter snow and the rain, and serve as a water reservoir to supply wells and crops. Wheat, corn, alfalfa, and numerous feed crops are grown on the loams and sandy loams. The fine sandy loam is very good truck and corn land and is the best soil for apples. The valley has many large commercial orchards of apples, pears, and peaches, a few of which contain several hundred acres.

The Little Arkansas River Valley is 1–3 miles wide and crosses the northeastern corner of the area. It is a shallow sand- and clay-filled trench similar to the Arkansas Valley. On the south it merges into a sand-dune upland, and on the north into rolling prairies. The North Fork of the Ninnescah River and its tributaries have cut narrow valleys in the southern and western parts of the area. These flat-bottomed valleys are ¼–1 mile in width and 20–100 feet below the bordering hilly prairies. In the southeast, the river and its tributaries have cut down to the Red Beds, producing a more rolling and eroded surface. Here the soils are reddish brown clay and very difficult to cultivate, as they are too hard when dry and too sticky when wet. Though some crops are produced, much of this section is used for pasture and the population is sparse. In most other parts of this physiographic region, the soils are good and produce crops similar to those of the prairie region.

The principal dune regions are located chiefly north of the Arkansas Valley and in the northwestern and western parts of the county. The sand hills are 10–30 feet high and have numerous small marshy areas between them. They are rarely cultivated, but the coarse grass provides a poor grade of pasture for herds of cattle.

A Variable Climate. Since the county is in the transition belt between the humid and semiarid portions of the country the climate wields a large influence in its material development. The growing season of 180–190 days is usually hot in midsummer, with a mean temperature of 77° and a maximum of 109°. Periods of very high temperatures may last for several days, and 100° may occur frequently. There are also occasional periods when strong, hot, dry winds sweep over the plains, and crops are likely to be damaged seriously; but these winds do not occur frequently during any one season. The average winter is mild (34°), but some winters are very severe, with strong, cold winds, and an absolute minimum temperature of −24° has been recorded. Winter cold, however, does little damage to crops.

As a part of the Great Plains, the area suffers the precariousness of rainfall that characterizes that region, though to a somewhat lesser degree. The mean annual rainfall of 28 inches is adequate when it comes at the right time. The average rainfall for the growing season is 18.7 inches but varies from 11.6 inches to 26.7 inches. This variability gives some seasons in which the precipitation is far below normal, or fails to come at the time when it is of the greatest value for a mixed-farming, humid type of agriculture. Normally there is sufficient to prevent a complete crop failure during any dry season, but the considerable seasonal fluctuations and high temperatures, combined with strong winds and high evaporation, maintain the element of uncertainty, and produce large variations in crop yield. With a small rainfall margin of safety, a comparatively small drop below normal converts the region from a humid to a semiarid condition. Hence, "good and bad years" follow closely the amount and distribution of rainfall and summer heat. The winter snowfall of 21 inches is particularly significant in such an area of pervious soils, as most of the moisture enters readily. It is common practice to keep the fields rough and trashy in winter to prevent the snow from blowing away. Old straw is commonly spread upon the sandy soils to keep both snow and soil from drifting and to add mulch.

Agriculture. Agriculture is the dominant industry of the region (Fig. 88). All the land area is in farms; more than three-fourths of the farm land is in crops and nearly one-fourth is pastured. Many farmers, especially on the heavier loam and clay loam soils, specialize in one or two crops, producing them on an extensive scale. The land is preeminently one of cereals, especially small grains, with more than two-thirds of the cultivated land devoted to their culture. Wheat occupies a dominant position, as more than three-fifths of the cropland is devoted to it. All other cultivated crops are insignificant in comparison. Wheat is likely to retain its relative place in the agricultural system because it can be marketed at any time, is well adapted to the soils, is better suited to large-scale farming methods with a minimum of labor than other available crops, and is probably a more certain crop under the climatic conditions than any of the other small grains. The broad expanse of level plains is highly favorable to the use of modern machinery.

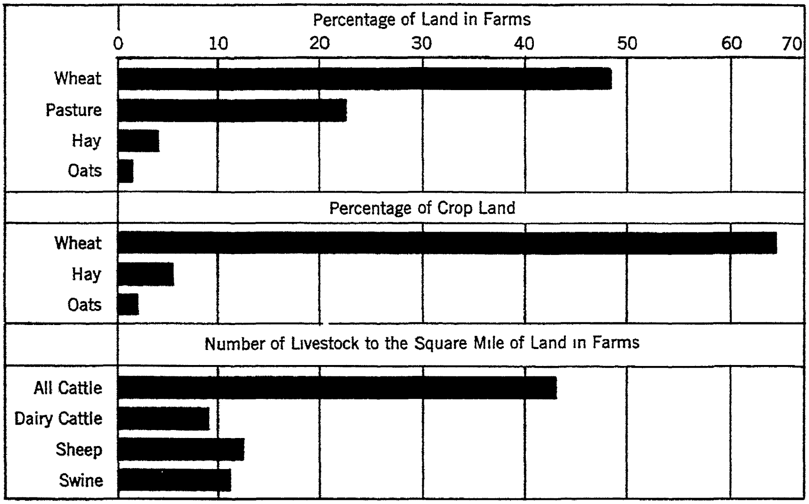

Fig. 88. Land use in Reno County, Kansas.

Conservation of moisture is always a necessity, hence the wheat lands are commonly plowed or listed from the middle of July to late September and worked down level with a mulch surface. Early working is preferble, as the soil is then in the best condition. Hard winter wheat is grown, and the seeding extends from September 15 to November 1. June is harvest time, and the yield averages 16 bushels an acre, though it varies considerably from season to season.

Sorghum, oats, hay, and corn are all grown, but the acreage of each is relatively very small. Corn is grown principally for grain and is produced chiefly on the sandy loams where mulching by cultivation reduces evaporation most effectively. The average yield of 15–20 bushels, compared with 50–60 bushels on the best soils in good years, indicates the sensitiveness of the crop to seasonal fluctuations in weather. Failure of rain to come at the right time—even if it comes at some other time—results in serious damage to the corn, as evaporation from the growing plant under hot winds is excessive. The corn land is commonly prepared by listing. Though this method has serious defects it has compensating advantages, as the trench and ridge produced lessen soil drift under the strong winds, and retain the snow—when the ground has been prepared in the late fall—and the moisture derived from its melting. The seed is planted in the bottom of the lister trench and the soil brought in about the growing plants by cultivation until the ground is again essentially level and the crop has reached a height sufficient to prevent soil drift. The corn and oat crops are produced chiefly to feed farm animals. The oat yield is usually small, as the prevalent dry weather retards germination in the spring and the strong winds blow the soil away from the roots of the young plants. Other minor crops include kafir, milo, rye, barley, Sudan grass, sweet clover, and cowpeas, and are grown for fodder or pasture, but the acreage of each is small. Kafir is well adapted to the dry seasons and to the soils, is one of the most certain crops, and is likely to increase in importance as a rotating crop.

Hay and forage crops rank next to wheat in acreage. Alfalfa is the dominant cultivated hay crop though it is difficult to get started on account of the strong winds and dry soils. A fourth of the acreage devoted to hay crops produces a coarse, wild, nutritious grass, which is cut from meadows along the smaller streams and wet, low areas among the sand hills. These crops are used for winter feed for farm animals and for fattening cattle.

The raising of livestock is of secondary importance as this is a land of wheat and other small grains. Many swine are produced in connection with general farming; but there are few large droves, and the total number is small compared with that of a corn belt county. Four-fifths of the cattle are of the beef type, and some are raised by most farmers. A few specialize in cattle, but there is practically no "cattle ranching," as such is known farther west, though the sand-hill country supports many head. Large numbers of cattle and several thousand sheep are imported each winter and fattened on corn, cowpeas, alfalfa, corn fodder, and wild hay. They are marketed chiefly in Kansas City. This is the most important phase of the livestock industry. About a fifth of the cattle normally maintained on the farms is for dairy purposes, and the products are principally for home consumption. Any surplus is marketed in the village or city centers, especially at Hutchinson, where there is a large creamery that purchases milk from an extensive territory in this part of the state. Main and branch lines of four large railroad systems cross the area and provide good transportation facilities to all the large markets, such as Kansas City, Chicago, Omaha, and Denver. Most farms are less than 6 or 8 miles from a railroad shipping point, but there are some in the northwestern part of the area that are 10–12 miles away.

Living conditions in the farm home of today are in striking contrast to those of only a few years ago. Modern machinery has relieved man from much of the heavy drudgery as well as increasing production per man-hour. Even though they are located on the margin of the humid area of the country more than a third of the farm homes have running water. Ninety-five per cent have automobiles, 80 per cent have radios, nearly 70 per cent have telephones, and more than 60 per cent are supplied with electricity. With diversification, increased efficiency, and greater income has come a higher standard of living.

Urban Centers. The county has 13 urban centers within it, varying in population from 100 to 33,500. More than four-fifths of the urban population lives in Hutchinson, which contains three-fifths of the inhabitants of the county. Railroads radiate from it in many directions, and it is the chief distributing and shipping point for a large part of western Kansas. Wheat is brought here from a large territory, and cleaned, graded, and reshipped to other milling centers for export. The city has 60 or more manufacturing establishments, closely related to the resources of the region and to the needs of the people of the vicinity. Most of the enterprises are small, but several have products valued at more than $1,000,000 annually. Among its industries are grain elevators, flour mills, salt, straw-board, and soda-ash factories. Industries of the other towns are confined principally to creameries or milk-receiving stations, and the handling of grain.

Summary. The gently rolling Plains country about Hutchinson, with its generally fertile soils, is primarily a grain-producing area. It lies in that border region where a variable climate makes agriculture very precarious, though total crop failure rarely occurs. When rainfall is sufficient and properly distributed, and strong, hot, dry winds are not too frequent, prosperity reigns; but a succession of seasons with unfavorable weather may convert this area to a semiarid land, and sweep away the gains of good years. This is a region where man presses his humid agricultural system into the margin of the semiarid—a climate and soil to which small grains, especially winter wheat, are better adapted than most other crops—but where small returns must be expected part of the time. Even though the handicaps may appear severe, the average production is large; and the growth of cereals and feed crops with the raising and fattening of livestock is likely to continue to be the type of husbandry best adapted to conditions. Unfavorable weather in such a region produces not only poor crops and "bad years," but also human discontent which is reflected frequently in state and national politics. Because of the numerous "issues" or "movements" that have arisen in the Middle West, it may be called the "emotion region of the United States," and Kansas may be taken as the center. However much such a statement should be qualified, it is worthy of note that most of the "movements" originating in Kansas were associated with agriculture in the western two-thirds of the state. That the reasoning of its people on national problems should be different from that of people living in the manufacturing East is to be expected, since the outlook on life in the two regions is influenced by strikingly different natural environments. Who can say which is right and which is wrong? May not the greatest good ultimately come from a mutually better understanding of the conditions under which each group of people lives?

CORN AND MEAT

The Primacy of the Corn Crop. Corn is both the pioneer and the premier American crop. It was one of the first crops grown on American farms, if not the first. It was being produced in America when the colonists first settled in Massachusetts and Virginia, and it was the Indian who taught the colonists how to grow it. In 1609 the Virginia colonists had 30–40 acres in corn; in 1614, 500 acres, and in 1631 a surplus was produced for export. As the people migrated westward, corn was one of the principal crops carried with them. This westward movement of corn growing began immediately following the Revolutionary War and spread into the Northwest Territory, Tennessee, and Kentucky. By 1839 it was well across the Mississippi River. The introduction of the steel plow, especially adapted to the breaking of the prairie, and later the advance of the railroad into the region, hastened the expansion of the corn area over the prairies. Its most intensive culture became established in what has become known commonly as the corn belt, an area extending from central Ohio to southeastern South Dakota and thence southward along the Missouri River, occupying parts or the whole of the states of Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri. This large area, except in the East, consists of fertile, well-drained prairie or bottom lands, easily worked (Fig. 12).

Climate and Corn. Though corn is widely grown in the United States, being produced in every state and on three-fourths of the farms of the country, the principal producing area is limited to the central part of the country (Fig. 89). The principal limiting factors are rainfall, temperature, and length of growing season, though soil plays its part. The largest yields are obtained in well-drained, fertile, loamy soil of high humus and available nitrogen content and well adapted to the use of the labor-saving machinery. The climatic bounds of the Corn Belt are "a mean summer temperature of 70° to 80°, a mean night temperature exceeding 58°, a frostless season of over 140 days, and an annual precipitation of 25 to 50 inches, of which 7 inches occurs during July and August."[4] Essentially, no corn is grown where the average summer temperature is less than 66° or where the average summer night temperature falls below 55°. Low summer temperatures, therefore, are the principal limiting factors at the north; the western limit is practically the mean summer rainfall line of 8 inches. July is the critical month, and the rainfall of that month is very closely related to the yield. The combination of these ideal conditions of

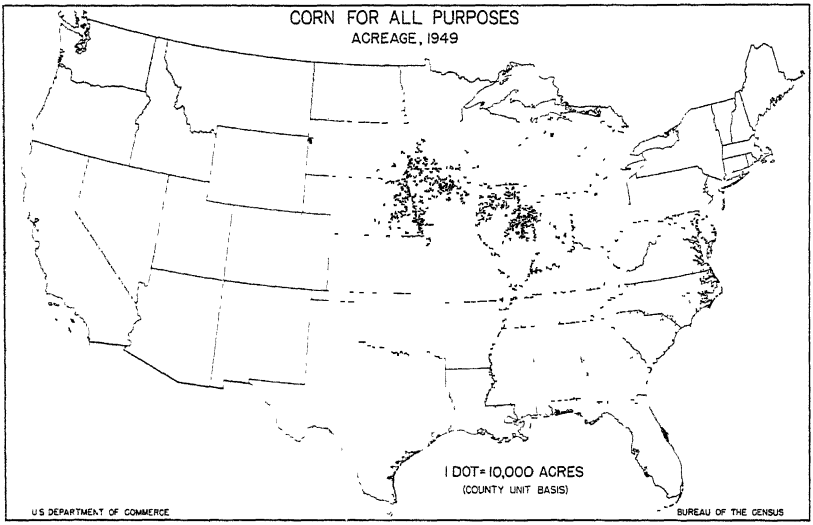

Fig. 89. The distribution of corn.

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[4] Finch and Baker, "Geography of World Agriculture," U. S. Govt. Printing Office, 1917, p. 29.

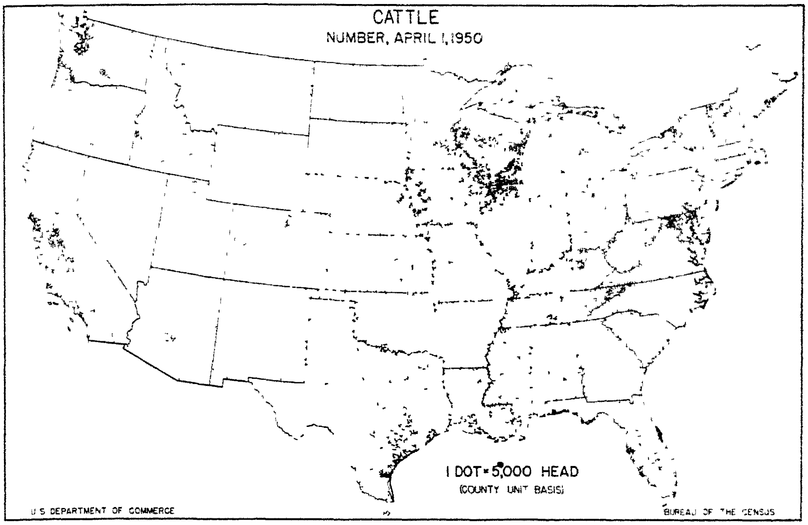

Fig. 90 Beef cattle exceed slightly dairy cattle in number, but their value is a little less. Nearly half the total number of beef cattle in the United States are in the Corn Belt and the Great Plains Region

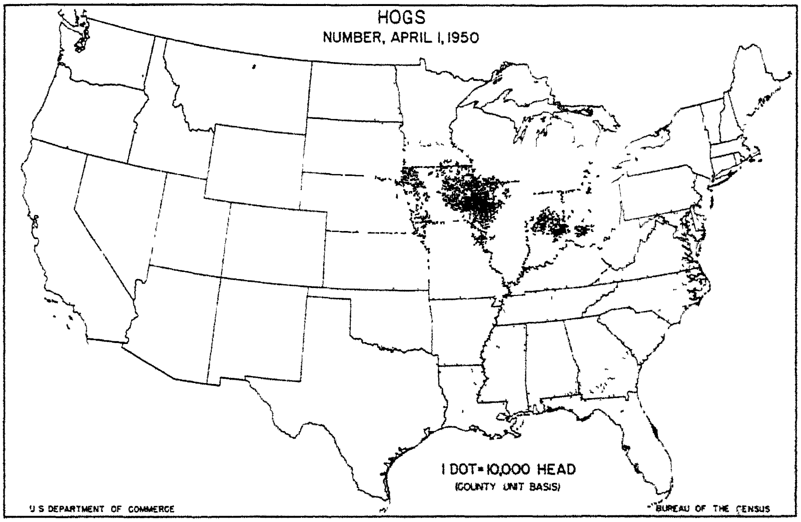

Fig. 91. More than two-fifths of the swine are in the warm, rich Corn Belt where they average more than 100 to the square mile. The Cotton Belt and Corn and Winter-Wheat Belt have about one-fifth each.

soil and climate makes the Corn Belt the world's greatest food-producing area. Few other places possess these ideal conditions, and none are as extensive. The northern and southern limits of corn grown for grain are now practically reached, though early maturing varieties and growth for forage or green fodder may extend its culture still farther north. The warm, moist conditions of the South produce a large vegetative growth but low-quality grain.

Related Crops. Corn is not the only crop grown in this great agricultural region. In fact, it is grown on less than half of the croplands in the Corn Belt. More than half the agricultural land grows hay, soybeans, and small grains. These may be harvested when labor is free from corn cultivation; they supplement corn as stock feed; and they maintain the soil fertility. Temperature, moisture, and soil are the important factors determining the choice of such crops. In the northern part of the Corn Belt, from northwestern Indiana to northeastern Nebraska, oats is the principal small grain, and on the south and east it is winter wheat. West of a line extending from Kansas City, Missouri, to Sioux City, Iowa, crossing the other two small-grain sections, alfalfa is the chief hay; and, to the east, clover and timothy. This selection is determined largely by the moisture supply to the east and west of this line. Soybeans are also a major crop in Illinois, Iowa, and Indiana. The Corn Belt is, therefore, a large producer of spring oats, clover, timothy, alfalfa, winter wheat, and soybeans.

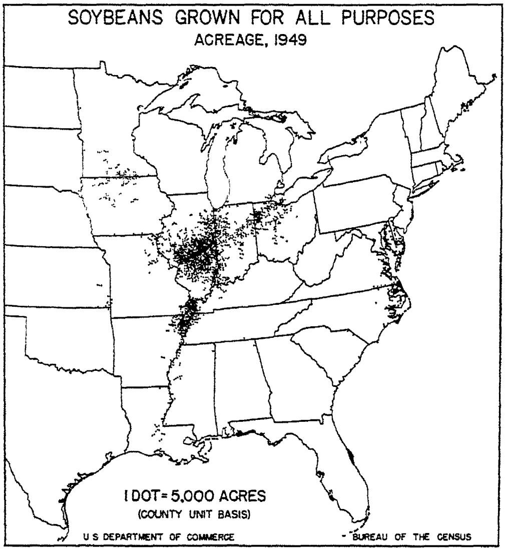

Fig. 92. Distribution of soybeans.

The relative importance of this production is shown in Table X. Closely related to the production of these crops is the raising of hogs, beef cattle, and poultry.

Importance of Corn. Corn is the leading crop of the United States. Its value in 3 out of 4 years is greater than the total value of wheat and cotton, and usually double the value of either. A hundred million acres is devoted to it, and it is grown on three-fourths of the farms in the United States. It is typically an American crop, as the United States produces about three-fifths of the world's crop, more than three-fifths of which is produced in the Corn Belt. As a food producer it is prolific, as it yields twice as much grain and, inclusive of forage, more than three times as much food to the acre as either oats or wheat. Directly and indirectly, it is the chief food source of the people of the United States. However, outside the South, less than 10 per cent is used directly as human food.

TABLE X

PROPORTION OF SELECTED PRODUCTS OF THE UNITED STATES PRODUCED IN THE CORN BELT STATES

1. 82.8 per cent of soybeans.
2. 66.2 per cent of corn.
3. 54.3 per cent of hogs.
4. 80.5 per cent of oats.
5. 31.7 per cent of all chickens and turkeys.
6. 23.5 per cent of all wheat.
7. 27.2 per cent of all cattle.
8. 27.2 per cent of hay.
9. 26.2 per cent of milk cows.
10. 24.1 per cent of total net value of manufactures.

Corn, swine, and cattle are intimately related (Figs. 89, 90, 91, 95). The regions of densest swine and corn production are practically identical, except where corn is sold as grain. The sale of corn as grain is usually determined by nearness to large markets, such as Chicago, where it is manufactured into starch, cornmeal, glucose, or other corn products. Beyond a radius of 150–200 miles from that center corn goes to market "on the hoof," as in such concentrated form it can better stand the cost of transportation. Two-thirds of the corn, four-fifths of the soybeans and oats, about one-quarter of the wheat, all cattle, milk cows, and more than half the swine are produced in the Corn Belt. Great numbers of cattle and sheep are brought in from the Western grassland plains and fattened for the market. Livestock on farms alone consume more than four-fifths of all of the corn crop. Scarcely a quarter of the crop goes out of the county in which it is grown, and less than 1 per cent finds a foreign market, a condition that is in striking contrast to wheat marketing.

The Present and Future of the Corn Region. For many years the efforts of the Corn Belt farmer have been directed toward producing larger and larger crops. Ideal geographic conditions and a hungry world population able to pay for high-quality food have fostered his efforts. The world demand for corn-fed beef, pork, and other corn products have made corn the most profitable crop that could be produced in the Corn Belt. Land values rose rapidly to high levels during World War I, along with prices of products. Modern conveniences were added to farm homes, and many other improvements were made. At the close of the war, prices of corn products declined more rapidly than the commodities purchased by the farmer. At the same time, the cost of moving his products remained high. High-priced farm property, increasing ratio of debt to property value, declining price and demand for Corn Belt products in Europe, relatively high freight rates, and large production combined to produce a decrease in rural population and much economic distress. During World War II prices again rose to a high level and have been sustained artificially by government subsidies. The North Central Section has now developed strong secitonalism finding expression as an agrarian *bloc* in American politics. In this respect the history of the Corn Belt is not unlike that of other sections of the United States in which the people have in the past reflected the dominant interest of their environment or do so today. Perhaps another epoch will see an adjustment of production to consumption and a counter-balancing influence brought about by the further development of manufacturing and trade. It seems probable that climate and soil will continue to make the present types of products the most profitable ones to produce in the Corn Belt.

A CORN BELT UNIT

Adair County situated about 50 miles southwest of Des Moines and 75 miles east of Omaha and Council Bluffs, may be taken as a typical agricultural area in the Iowa portion of the Corn Belt. It lies on the watershed between the Missouri and the Des Moines Rivers. This watershed extends from the northwest corner of the county to its center, where it bears eastward, and where a branch divide extends southward. Numerous small ridges radiate from these principal divides, but as a whole the surface is gently rolling with broken belts along the numerous streams which reach practically all parts of the area. No marshes, ponds, or lakes worth mentioning exist. The "rougher" lands occur in the southwestern and southeastern parts, but the range in elevation for the county is very small, being less than 250 feet, and the extensive development of highways on the sectional plan divides it into a nearly uniform checkerboard

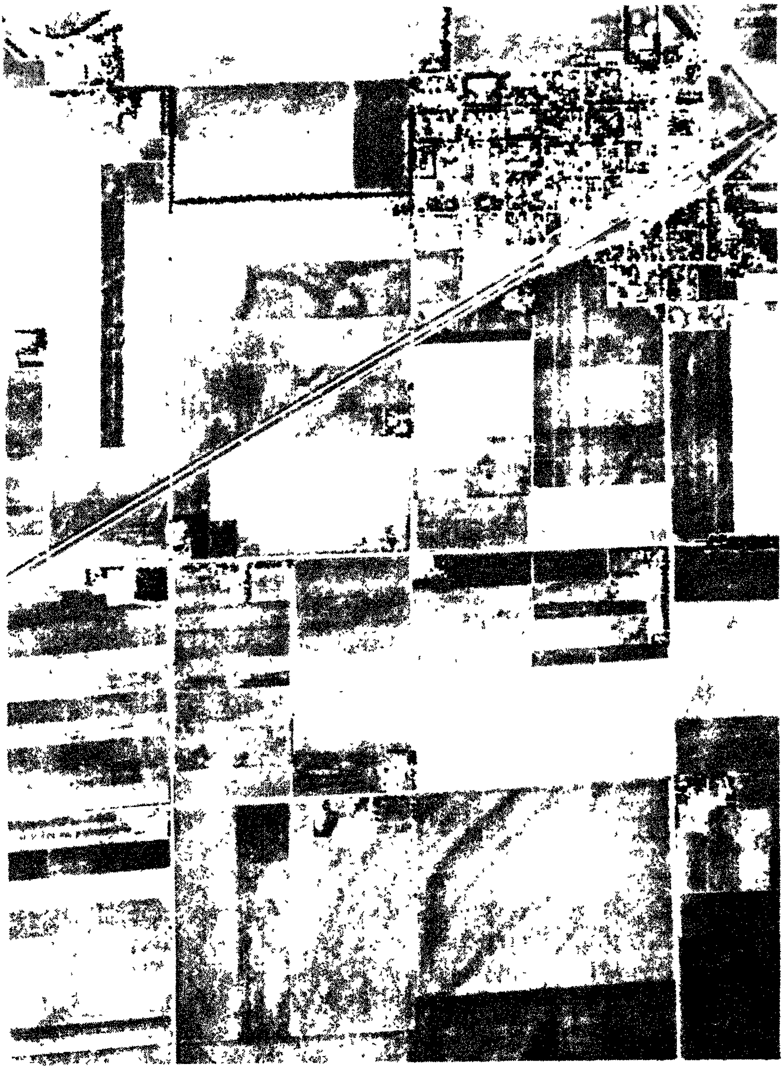

Fig. 93. Agricultural pattern in Monona County, Iowa, and a small rural community center. *Courtesy, U. S Production and Marketing Administration.*

pattern. Nearly all the soil is of glacial origin but modified by wind, streams, and other weathering agencies. Over the more elevated surfaces rests a mantle of loess, and, on the lowland, alluvial soils representing wash from the uplands.

The climate is characterized by long, warm summers and moderately cold winters, with extremes rarely prolonged sufficiently to injure crops or livestock seriously. Temperatures for the three summer months average 72°, and for the three winter months 22°. With a growing season of 165 days; an average annual rainfall of 33 inches, seven-tenths of which comes in the spring and summer months; with rich soils on a land of low relief; and with good transportation facilities to markets, the area presents conditions highly favorable to agricultural development.

The first settler came in 1849. Other settlers soon followed in rapidly increasing numbers, and the county was organized in 1851. Most of the early immigrants came from eastern states, and 95 per cent of the present inhabitants are native-born. There are a few hundred of German and Scandinavian origin. The population is wholly rural, as there are only 7 small vilages, 3 of which are on the county boundary lines. The largest village is Greenfield, with a population of 2000, located near the center of the county. The farm population averages about 13 to the square mile of farm land, and the total population, including the villages, averages 23. As in many other rural districts, the population decreased during the last census decade. Today the county's 569 square miles of gently undulating surface, covered by dark brown to black fertile loam soils, presents a panorama of well-kept farm homes and other buildings, and well-tilled fields enclosed by mile upon mile of barbed-wire fence modified in part by woven-wire bases where required to confine the thousands of swine that are raised annually and fattened upon the chief crop—corn. Nine-tenths of the homes have radios and telephones, nearly half have electricity, one-quarter are provided with running water, and there are more automobiles than farms. Practically the only areas not cultivated are the more broken sections which are kept in permanent pasture, and farm woodlots. The woodlands and the other unimproved lands in farms constitute a very small part of the entire area of the farm land. Telephones and rural mail service reach all parts of the area, and modern farm machinery and other equipment are in common use. It is preeminently a farming area with a few small rural villages serving the local needs of a farm population.

Production of Feed Crops. Farming has been the dominant industry since the arrival of the first settler and is likely to remain so. In the early days the livestock was herded on the open range, often by contract, and only the cultivated fields were fenced. As the population increased the fenced areas came to occupy an ever-increasing proportion of the land area, and the open ranges were largely taken up by the late 1870's and early 1880's. Flax was used frequently as a breaking crop in the early days, but its growth was practically discontinued in the decade following 1900. The original type of agriculture—livestock and feed crops—has continued to increase in importance. This type has as its basis the raising of livestock, especially hogs and beef cattle, and to a smaller extent sheep, horses, and mules, and the production of food crops chiefly supports the animal industries. Some grain, principally wheat and corn, is marketed. Oats, barley, rye, sorghum, mixed grains, soybeans, sweet clover, timothy, clover, alfalfa, and prairie grass comprise essentially all the crops utilized for animal sustenance.

Adair County is truly a part of that "land where the tall corn grows," as more than 43 per cent of its cultivated land is devoted to corn. During the summer months the landscape resembles one continuous corn field dotted at frequent intervals by groves of trees, in the midst of which are set a fine home and excellent farm buildings equipped with most modern conveniences. Even though corn may be grown on the same land for several years in succession, the average yield is about 40 bushels an acre. Corn lands are commonly plowed in the fall if time is then available, but much of the acreage is not prepared for the crop until spring. The planting is done during the first half of May with automatic planters, and the corn is cultivated three or four times during the season. The matured ears are "snapped," by hand or machine, from the stalks in the fall and stored in cribs for feeding. Some corn is now cut by machinery for silage or for fodder-feeding during the winter.

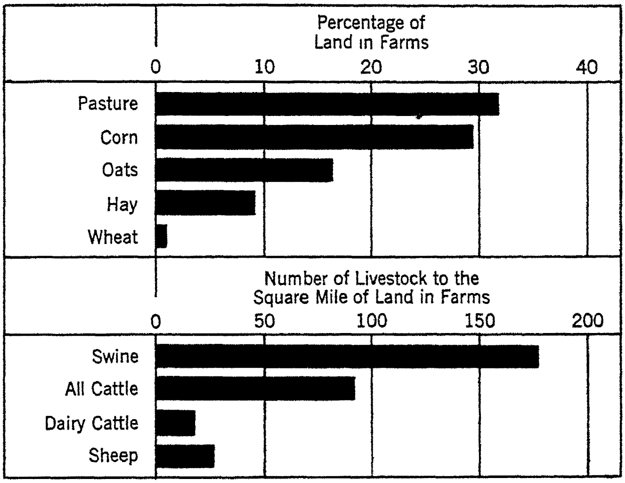

Fig. 94. Agricultural practice in Adair County, Iowa. Most crops of Adair County are produced for stock food. Corn acreage is nearly twice that of any other crop. Nearly a third of the land in farms is devoted to pasture.

Oats rank next to corn, and are produced chiefly as food for animals. Only occasionally is there a surplus for market. They are sown in the latter part of March if the season is favorable, but more commonly during the first half of April, and are thus "out of the way" before corn-planting time.

Hay crops rank next to oats and are produced in considerable variety. Practically the entire production is fed on the farms of the county.

Wheat is not considered a profitable crop under normal conditions. Most of the wheat is of the winter variety and is sown in the latter part of September. The spring variety is sown about the same time as oats. Nearly all the threshing is done from the shock in the field, but some wheat is stacked to be threshed later.

Barley, rye, and soybeans are minor crops used primarily as stock food. Potatoes for family use are grown in small patches on most farms. Nearly every farm maintains an apple orchard, and there are some peach, plum, pear, and cherry trees, and various small berry fruits to supply the home needs.

Production of Livestock. Swine, cattle, and sheep are the principal animals raised. There are more than 98,900 swine, 52,000 cattle, and 14,400 sheep on the farms of the county. Chickens are also produced on all farms and the surplus products are disposed of in local markets. Practically every farmer raises and fattens swine, and the average farmer markets from 50 to 60 a year. Many of the swine produced are purebred or very high-grade stock.

Cattle are nearly all of the beef type, and this type has about twice the monetary value of swine. Most of the cattle are raised locally, but some feeders are imported for fattening. The herds range in size from 25 to 30 on a quarter-section farm, to 100 or more. Dairy cattle are only a sixth as numerous as the beef type, and, though dairying is considered only an incidental farm industry it provides a substantial farm income yearly. The cream is separated on the farm and sold to creameries, such as the cooperative creamery at Greenfield from which the butter is shipped to distant markets.

Sheep are of much less importance than cattle or swine and are raised more generally in the rougher lands of the southeastern and western parts of the county. Markets for cattle, swine, sheep, and other livestock are readily accessible at Omaha, St. Joseph, Kansas City, Des Moines, and Chicago.

Adair County is a typical agricultural area specializing in meat-producing livestock, and stock-food crops. Ninety-eight per cent of its total area is in farms. Its farms average 175 acres in size, and, inclusive of buildings, represents an average investment of about $19,500. Nearly three-fifths of its farm land is operated by owners and part owners.

HAY AND FORAGE—DAIRYING

Importance of Hay and Forage. Hay and forage constitute one of the most important crops produced in the United States. The term includes a great variety of both cultivated and wild grasses, of which timothy, clover, alfalfa, and prairie are the leading ones. Most of the prairie hay and alfalfa are grown in the drier western portion of the North Central Section; the others thrive best in the more humid and cooler eastern portions. The growth of hay and forage is not restricted by geographic conditions as are many other crops and hence is widespread, being adapted to climates ranging from hot to cold and humid to arid, and also to a great variety of soils. Abundant moisture during the growing season, with little rain and much sunshine during the curing period, and well-drained clay soil are conducive to successful production. Its selection as a major crop in a given area is the joint result of geographic and economic factors. The large amounts required for stock feed make it the second most important crop in the North Central States, where nearly half the crop of the United States is produced. These states have half the dairy cattle, and produce four-fifths of the butter and cheese. As population increases there is a tendency to increase the acre yield. Under present conditions,

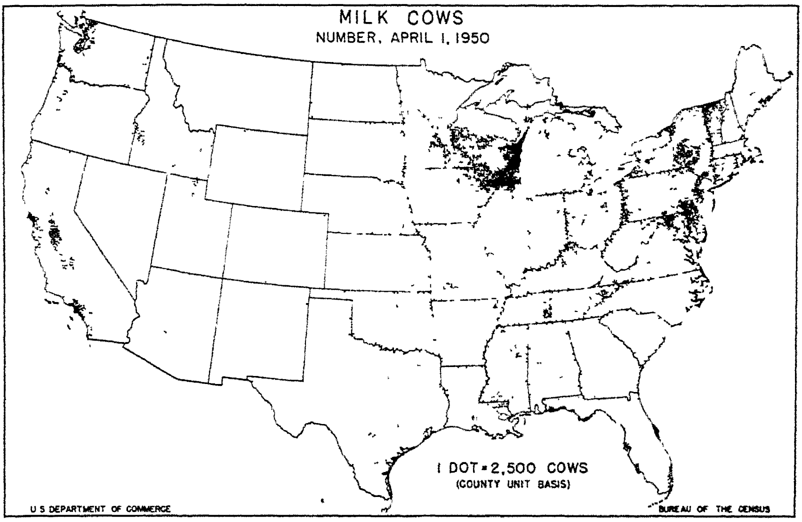

Fig. 95. Distribution of milk cows. Nine-tenths of the dairy cattle are in the eastern part of the country, mostly in the cool Hay and Dairy Region and in the adjacent eastern and northern margin of the Corn Belt.

permanent agriculture has its most substantial basis in the production of forage crops and livestock, which means a system of general farming. Such a system is enduring because (1) legumes constitute many of the forage crops and add nitrogen to the soil; (2) the decaying fine roots of grasses provide nourishment for nitrogen-fixing bacteria, add humus to the soil, and serve to keep it in excellent tilth; (3) animal manure is unexcelled by any artificial fertilizer; and (4) the system tends to maintain economic stability. From the standpoint of value, dairy cattle comprise the most important type of livestock on the farms of the United States today.

Specialization in the North. The northern region has passed through several periods of agricultural development and has attained a more advanced stage than have most other parts of the North Central Section. The exploring-hunting stage was followed by pastoral husbandry, when the pioneer settlers pastured a few cattle and sheep in the forest lands. Then came specialization in grain growing, as transportation facilities, such as railroads, canals, and lakes, became available for marketing the crops; and finally came the system of mixed farming in which hay and forage and dairying became dominant, a system associated with a denser population than normally exists at the other stages named. A number of geographic, economic, and human factors have fostered, in Wisconsin, Michigan, Minnesota, and the adjacent northern edge of the Corn Belt, especially Illinois and Iowa, the development of hay and forage and the dairy industry. This development is in contrast with that of the wheat regions and of the corn belt in which one crop dominates agricultural economy. Among these influencing factors are the long winters, the cool, moist summers with moderately long growing and grazing season, which discourage the growth of grain in competition with more favorably endowed areas, but encourage dairying; abundant rain in frequent showers during the growing season but with little rain and much sunshine during the curing period; slight injury from drought; heavy snow cover which prevents serious loss from freezing; a glacially derived surface containing much hilly morainic land, many lakes and swamps, soils ranging from silts to sand and gravel not well suited to the growth of corn and other cereals; a fairly large population with a constant city demand for dairy products; a large population of north-European human stock familiar with the dairy industry.

Near city centers of dense population where modern rapid transportation facilities have been provided by railroads and trucks, a large proportion of the dairy products go to market as milk; and at more distant points the milk is condensed or converted into butter and cheese, which can better stand the cost of transportation.

Wisconsin the Leading State. Wisconsin is the leading dairy state. Its commercial milk is made into cheese and butter or is condensed. Its cheese output is nearly half that of the entire country. Of the United States production of American cheese the state supplies about two-fifths; brick and Münster nearly nine-tenths; Limburger nearly half: Swiss nearly two-thirds; Italian more than half; and nearly two-thirds of other varieties. Minnesota exceeds Wisconsin in the production of butter and is now the leading butter state, but Wisconsin ranks third, being exceeded by Iowa. The adjacent northern portion of Illinois, near the large city markets, likewise has a highly developed dairy industry. The leading position of Wisconsin is due to a combination of geographic, economic, and human factors. Its geographic and economic advantages are no better than exist elsewhere, but the influence of scientific research and able leadership has been profound. The contributions and far-sighted campaign of education among a people ancestrally, and in many cases personally, trained in dairying, and living in a physical environment highly conducive to the industry, have wielded a large influence in producing a stable agricultural system.

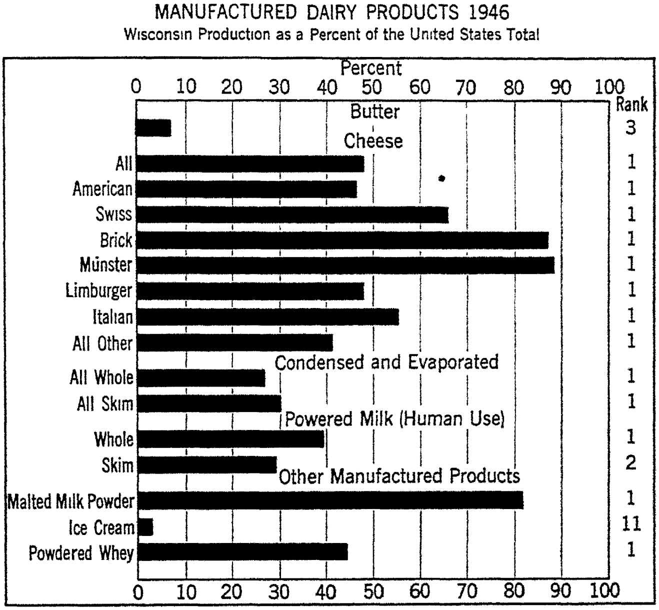

Fig. 96. Wisconsin dairy products in percentage of United States total. *Courtesy, Wisconsin Crop Reporting Service.* Wisconsin leads in the manufacture of dairy products except butter, powdered skim milk, and ice cream.

Dairying is well distributed over Wisconsin except in the forested, sparsely settled north and in the central region of poor, sandy soil. Dairy manufactures have become one of the leading industries. More than four-fifths of the farm income is derived from livestock and livestock products, and more than half the income comes from milk alone. The entire crop system is built around livestock, and dairying ranks first as a source of farm income in nearly every county of the state. As one traverses the leading dairy areas over the hard-surfaced highways he is impressed by the general appearance of substantial prosperity prevailing. In that cultural landscape he sees a gently rolling country of fenced fields of feed crops, well-kept farm homes and farm buildings, a silo on nearly every farm, a creamery or cheese factory on many of the crossroads with heavily loaded trucks delivering the cream or milk, and larger dairy factories in many of the towns located at frequent intervals throughout the region. He finds thousands of those homes equipped with every modern convenience, houses and barns electrically lighted, and a people who appear to be operating their industry on a modern business basis. Three-fourths of the state's dairy establishments are cheese factories. These plants are located chiefly in the central and east central sections near Lake Michigan, and in the rougher, unglaciated limestone lands of the southwest, where the nights are cool. The creameries are most abundant in the corn-growing section and are an adjustment to summer and winter dairying; cheese is mainly a response to summer dairying. The chief American cheddar cheese area is in the eastern lake shore section where the pioneer New Yorkers transplanted the industry and where the large German element in the population took it up and contributed to its successful development.

The production of so-called foreign cheese is confined largely to the two chief areas, of which Green County, in the Driftless limestone southwest, and Dodge County, in the glaciated limestone soils and 30 miles northeast of the first area, are the respective centers. The Green County area is a Swiss settlement, and the brick cheese of the Dodge County area was originated by a young Swiss.

MICHIGAN FRUIT BELT

A narrow belt along the western side of the lower peninsula of Michigan is one of the most important fruit-producing regions of the United States, chiefly because of the climatic influence of Lake Michigan. This belt produces great quantities of grapes, peaches, pears, apples, and small fruits. In these border counties is produced nearly seven-tenths of the total value of all fruit of the state, which is nearly four times that for the entire state of Wisconsin, located on the windward side of the Lake. The value of the fruit produced in Oceana County in Michigan is seventeen times that of Sheboygan County, directly across the lake in Wisconsin; and that of Berrien County, Michigan (in the extreme southwest) is three times that of all the Wisconsin counties bordering the lake, and more than one-fifth greater than that of the enire state. Door County, which receives the moderating influence of Green Bay from the west and Lake Michigan from the east, is the only Wisconsin County that compares favorably with Michigan counties along the eastern shore of the

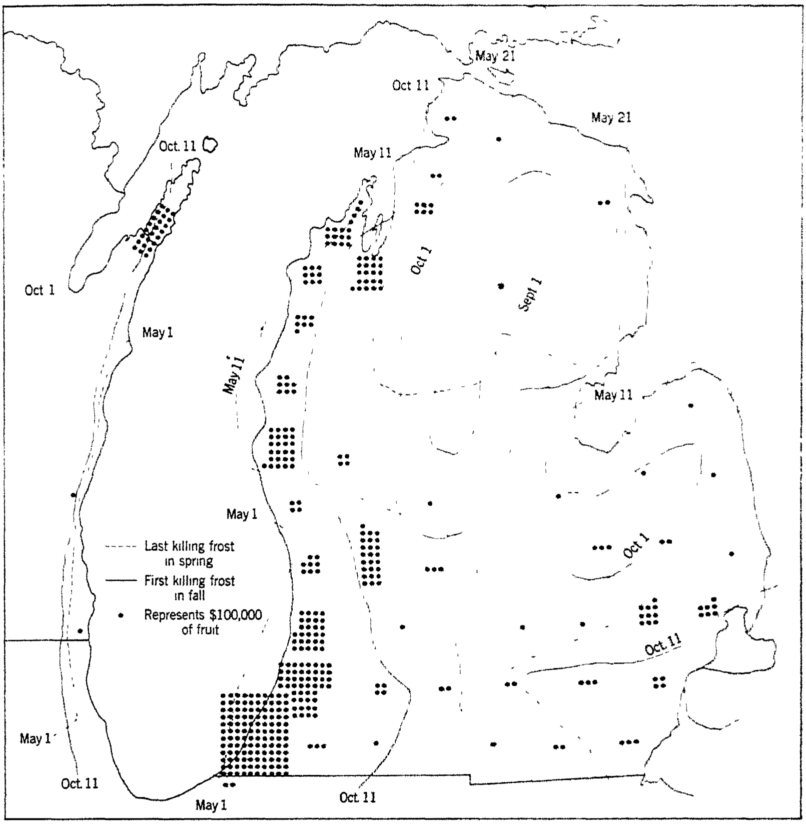

Fig. 97. Lake Michigan and the westerly winds are powerful factors in modifving the climate of western Michigan, and in influencing the kinds of crops produced and the recreation industry. In this narrow belt along the leeward Lake Michigan shore is produced nearly seven-tenths of the total value of all fruit grown in Michigan, and nearly four times that for the entire state of Wisconsin situated on the windward side of the lake.

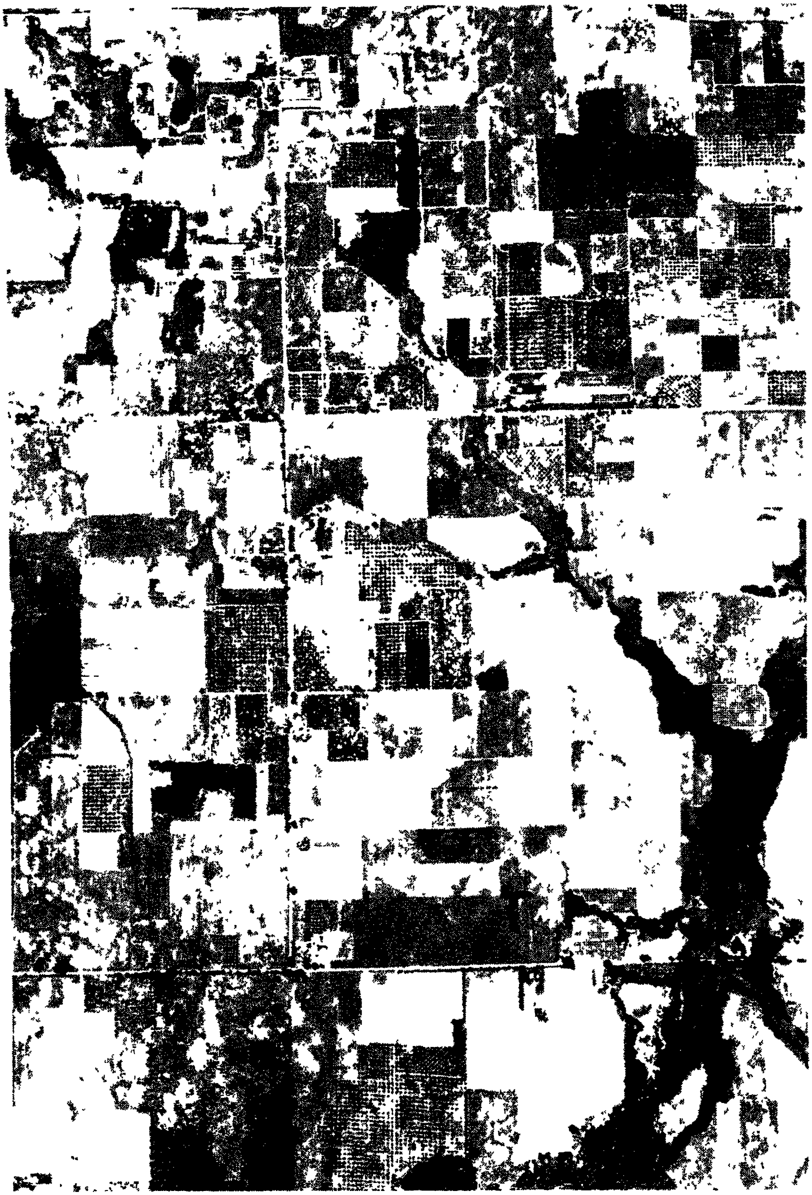

Fig. 98. Part of the Michigan fruit belt with Lake Michigan bordering the area on the left. *Courtesy, U. S. Production and Marketing Administration.*

lake (Figs. 97 and 98). The relative positions of Michigan and Wisconsin in fruit production does not imply, of course, that Wisconsin cannot produce fruit.

Climate, Lake Michigan, sandy-loam soil, and nearness to large city markets are the principal factors that have influenced the development of the Michigan fruit belt. The potency of Lake Michigan in raising the temperature and moisture content of the westerly winds, and in retarding early spring growth, is much greater in Michigan than in Wisconsin. This influence extends some 20 miles or more inland from its leeward shore and may be summarized as follows: (1) In spring the cool westerly winds from the lake retard plant growth until the danger from frost is past, and in autumn the relatively warm winds delay the first killing frosts until the more tender trees are ready for the winter. (2) A growing season of about 160 days prevails along the Michigan shore nearly to the northern extremity of the lower peninsula but decreases rapidly in length toward the northern interior. This gives the northern lake shore as long a growing season as the southern interior of the state. However, the length of the growing season is not greater than on the Wisconsin side. (3) The winter temperatures are much milder along the Michigan shore than in Wisconsin, and the extreme minimum temperature is never as low. The critical temperatures of -15° to -20°, which kill the buds, seldom occur on the Michigan shore but occur nearly every winter on the Wisconsin side. (4) The extreme summer temperatures are 6° to 10° lower on the Michigan shore than in the interior of the state. This is a large factor in the development of an extensive summer-resort business as well as in the production of fruit. (5) The snowfall of the Michigan shore counties is 10 inches to 20 inches greater than in the interior of the state or on the Wisconsin side. The percentage of winter cloudiness and summer sunshine is also greater than in Wisconsin, both of which favor fruit growing. The moist winters, which reduce the loss from "winter killing," and the delayed springs are probably the two most important climatic factors favoring the leeward shores of Lake Michigan as a fruit region.

Extensive areas of muck lands, lying in depressions among the glacial gravel and sandy hills, have been developed for production of truck crops. Large tonnages of vegetables are now being grown for canneries. Practically all of this type of land utilization is well inland from the lake, and the climatic influence of the lake is of little or no significance.

OTHER CROPS AND LIVESTOCK

Although there is crop and livestock specialization in the various agricultural regions previously described, these regions produce a large variety of other important agricultural products. The chief major producing sections of barley, rye, potatoes, sugar beets, tobacco, and flax are north of the Corn Belt, in regions of cooler summers and shorter growing seasons. Oats are grown extensively in the Corn Belt for stock food, and as a spring-sown crop in the system of rotation, but their culture extends to the northern border of the United States. Soybeans are another important crop of the Corn Belt. Enormous quantities of eggs and poultry meat are produced in the North Central Region, much of it coming from grain and stock farms rather than from specialized poultry farms. Sheep raising came into the region during its early settlement and has been retained as part of the farming system especially in southern Michigan and in Ohio where sheep are better adapted to the hilly pasture lands in the southeastern quarter than are cattle. With the exception of limited areas, sheep are now produced primarily for mutton.

PROBLEMS

1. Can the North Central Section maintain a population as dense as that of Germany?
2. Can the North Central Section maintain its position as the leading agricultural region of the United States?
3. Does prosperity in the Corn Belt depend upon the corn crop?
4. What change in the center of production of each of the leading crops of the North Central Section is likely to occur within the next century?
5. To what extent are geographic factors responsible for agricultural prosperity in the North Central Section?
6. To what extent are the farmer, manufacturer, banker, transporter, and city dweller interdependent?
7. To what extent does the prosperity of the United States farmer depend upon the prosperity of people in other parts of the world?
8. What states may equal or excel Wisconsin in dairying?

CHAPTER 9

North Central Section—The Industrial Lower Lake Region

A Region of Manifold Industries. The Industrial Lower Lake Region includes southern Michigan and Wisconsin, Ohio, Indiana, and Illinois, to which St. Louis is closely allied. It is a region of agriculture, mining, manufacturing, commerce, trains, trucks, buses, airplanes, boats, and many large cities. Among its people engaged in gainful occupations, approximately 32 per cent are in manufacturing industries; 15 per cent in transportation, communication and other public utilities; and 13 per cent in agriculture, indicating clearly the dominance of industry in the region.

Here are produced and collected great quantities of raw materials—iron ore from the north, coal from Illinois, Indiana, and the East, salt, forest products, rubber, petroleum and other minerals, wheat, oats, cattle, hogs, and many other farm and orchard products. These materials are fabricated into a multitude of finished articles—products of slaughtering and meat packing, of iron and steel plants, and of foundry and machine shops, automobiles, agricultural implements, rubber tires, engines, clothing; boots and shoes, *ad infinitum*—to meet the wants of the people in all parts of the world. It possesses a remarkable combination of vital resources that integrate so as to make it approximately an economic unit. These resources probably provide better for an all-round development than do the natural resources of any other section of the United States, and probably are unequaled in that respect outside the north central plains of Europe. In addition to the resources within the bounds of the Industrial Lower Lake Region, the coal power of Pennsylvania, West Virginia, Kentucky, and Tennessee may be drawn upon. However, the inland location places upon this region a freight-cost handicap in competition with the East which partially negates the advantages accruing from its superior wealth of natural resources. Since the upper waters of America's two great waterways—the Great Lakes-St. Lawrence, and the Mississippi—are but a short distance apart, a more effective commercial connection is likely to come ultimately. Such a connection will lessen but not remove entirely the disadvantage of location, as there are many economic factors unfavorable to long inland canal and river navigation compared with all-year transportation on the modern railroad or by highway. Today the Lower Lake Region is covered with a close network of excellent railways, airways, and highways and is traversed by the main transcontinental lines of the country.

FUEL AND POWER

Coal. Coal is still the chief source of fuel and power and, probably, is the most important factor in modern manufacturing development. Two of America's most important coal fields are located partially within the region, and one of the minor fields is confined to Michigan. Nearly all the Eastern Interior province lies in Illinois and Indiana, and part of the Appalachian province is in Ohio. Illinois, Ohio, and Indiana produce a fifth of the annual output of the country, and rank fourth, fifth, and sixth, respectively, among the states in the amount mined annually. Michigan produces a small amount, which is used locally, as better coal can be obtained easily. The reserves of bituminous coal are enormous. Those of the Interior province and part of the Appalachian province in Ohio, which lie wholly or largely in the Lower Lake Region, are approximately 530,000 million tons, and constitute more than two-fifths of the total bituminous reserves of the United States. The presence of these coals as a power source, in the midst of a rich agricutural region, has been a large factor in the rapid manufacturing development, in the growth of transportation facilities by rail and boat, and in the growth of such centers as St. Louis, Kansas City, Chicago, Cleveland, and many other Lake Cities where the coal meets the iron ore and where the products of the factory may secure cheap transportation. Coal as raw material has likewise given rise to coke and gas plants and to the production of many by-products.

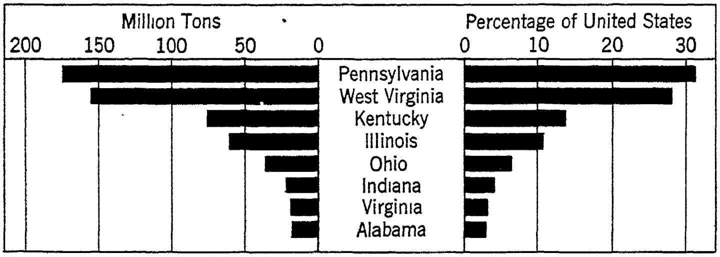

Fig. 99. Coal production by leading states. Three-year average. These eight states produce nine-tenths of the bituminous, lignite, and anthracite coal.

Petroleum and Natural Gas. As petroleum and natural gas production spread westward from Pennsylvania, Ohio, Indiana, and Illinois became leading states. But oil and natural gas are ephemeral bases of industry, as a large output continues for only a relatively few years in any field. Many villages were born, grew rapidly with the rise of the oil and gas industry, and sank into insignificance with its decline. For many years, petroleum and natural gas wielded a large influence in the industrial developmet of the region, and they are still of considerable importance, although most of the oil for refining comes into the region from more productive fields. The production is now small compared with that of other fields. The refining of petroleum remains a large industry, as oil is brought through pipe lines from the southwestern fields.

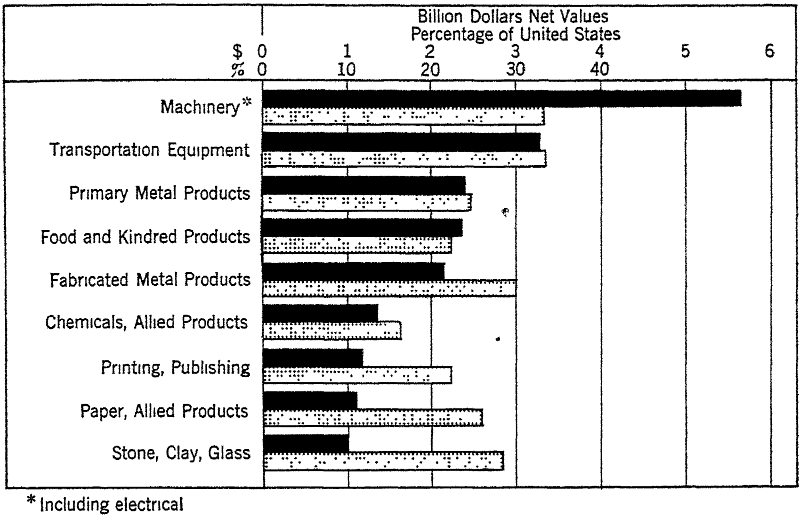

Fig. 100. Typical industrial groups of the Lower Lake Region (1951). The manufacturing industries of the Lower Lake Region are large and varied whether measured by net value or by percentage of the country's total production.

MAJOR INDUSTRIES

A Highly Developed Manufacturing Region. The Lower Lake Region possesses the essentials for successful manufacturing development: (1) abundant power, (2) abundant raw materials of great variety, (3) abundant labor and capital, (4) excellent transportation facilities, and (5) excellent, accessible market both within and without the region. Cities and manufacturing centers at focal points along the Lake shores profit by the great advantage of location. Veritably, they are creations of the Great Lakes; born but yesterday, their growth within a few generations has been phenomenal.

The industries of the region are almost as varied as human wants. For many years food products ranked first among its larger industrial groups, but is now surpassed by machinery, primary metal products, and transportation equipment, especially motor vehicles. The Lower Lake Region is the most densely settled portion of the North Central Section and the most highly industrialized. It has more than two-thirds the population, produces more than four-fifths of the net-value of manufactures, and has the same ratio of the manufacturing employees. The value of its manufactures constitutes one-third of the total for the United States.

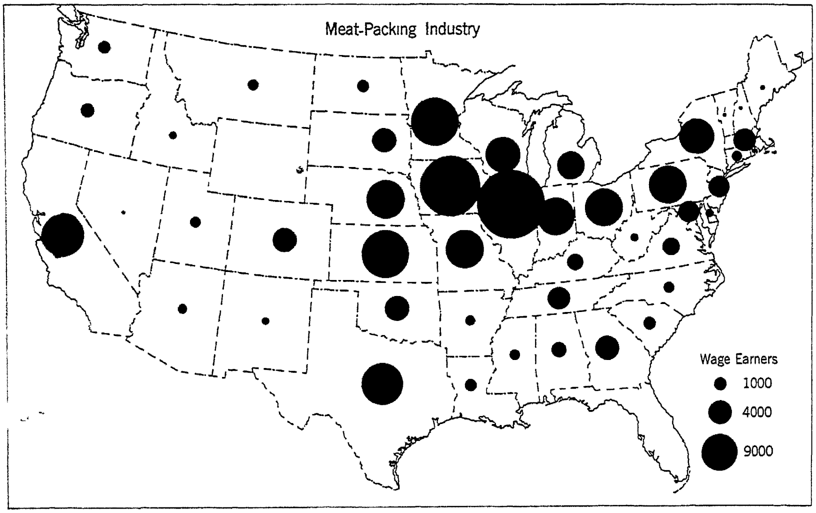

Fig. 101. The meat-packing industry is localized in the Corn Belt or near its margin. The industry in New York and New Jersey is centralized chiefly in the urban area about New York City where it meets the requirements of the large population for fresh meat.

Meat Packing. Among the food products, meat packing ranks high in value of products though its net value is relatively small. The industry is by no means confined to the Lower Lake Region. However, the high cost of shipping live animals, the loss sustained by injuries and in weight in shipping them, and the fact that only about half the live weight is meat have tended to centralize slaughtering and meat packing in the Corn Belt and on its margin. The principal centers are Chicago, St. Louis-East St. Louis, Omaha, Kansas City, St. Paul, St. Joseph, Denver, and Sioux City.

At the beginning of the nineteenth century livestock of the Central West had no market except a local one; but early in that century cattle were driven across the mountains from the Ohio Valley to the markets of Baltimore, Philadelphia, and New York. This method of marketing later extended to Indiana, Illinois, and Kentucky, and ended with the establishment of railroad connections with the East. As the railways were built still farther west, "cattle drives" from Texas and the high plains to "cow towns," located at the end of the rails, were organized. As the rails were pushed on still farther and farther west new "cow towns" arose at their termini. As the development of transportation was a controlling factor in the westward expansion of cattle raising, making it possible to ship animals to distant markets, the development of refrigeration (1875–1885) and other methods of preserving meat transformed the slaughtering industry from a local one to one of large-scale production at great railroad foci in the food- and animal-producing section, and made the world a market for meat products. Before the perfection of refrigeration, slaughtering was largely a winter industry and ceased almost entirely during the warm summer months except in very large consuming centers. With rapid transportation, refrigeration, a population able to buy such high-quality food as meat, and the concentration of the industry at great centers, have arisen giant corporations able to effect economies to a high degree and to utilize every part of the animal. Chicago was one of the first important centers and is still the leading one. Its stockyards

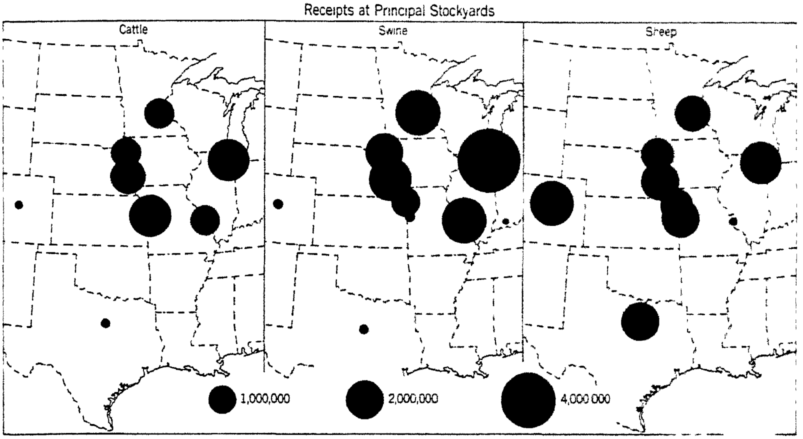

Fig. 102. Receipts at principal stockyards. These nine stockyards handle slightly more than half of all cattle, sheep, and swine received at the 68 public stockyards reporting.

receive approximately 6,100,000 animals annually, and the output of its meat-packing establishments is valued in the billions of dollars, exclusive of the numerous by-products.

Flour Milling. Flour milling (Fig. 103) is as typical of the North Central Region as are slaughtering and meat packing and the manufacture of agricultural implements. The modern large merchant flour mill tends to locate at transportation centers in or near the wheat-producing regions or in large consuming centers having low-cost transportation for wheat. Minneapolis illustrates the first type of location and is one of the largest wheat markets and flour-milling centers in the world. Coincident with the decline of the lumber industry and the invention of the processes that make possible the production of high-grade flour from spring wheat, the industry grew up about the power supplied by the Falls of St. Anthony. Kansas City, St. Louis, and Wichita are other centers of this type; and Chicago and Buffalo belong to the second class, where wheat may be brought by lake at low cost and where a dense population within a small radius provides a large market. The flour-milling industry in Buffalo—the concentration point at the east end of Lake Erie and on the principal route to the markets of the East and Europe—has grown rapidly, and that city now excels Minneapolis as a flour-producing center. Its location at the eastern end of Lake Erie and the water route for wheat, excellent power resources from Niagara Falls and from Pennsylvania coal,

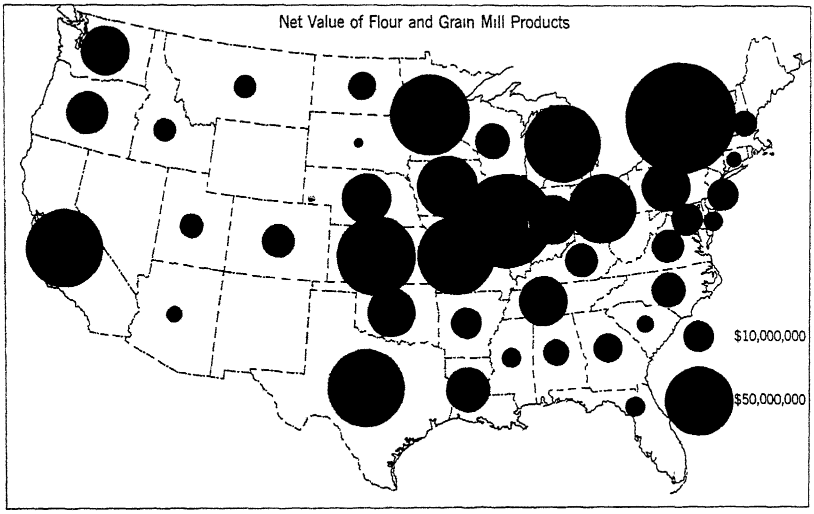

Fig. 103. Distribution of the flour and gristmill industry.

and nearness to a large market give it decided advantages over Minneapolis.

Iron and Steel Industry. Large-scale production of iron and steel has attained commanding significance since about 1920. The use of iron and steel today is very largely a measure of the industrial importance of a nation. Modern industry demands power, especially coal, and millions of tons of steel. The evolution of the iron and steel industry in America may be divided into three quite distinct periods on the basis of the fuel

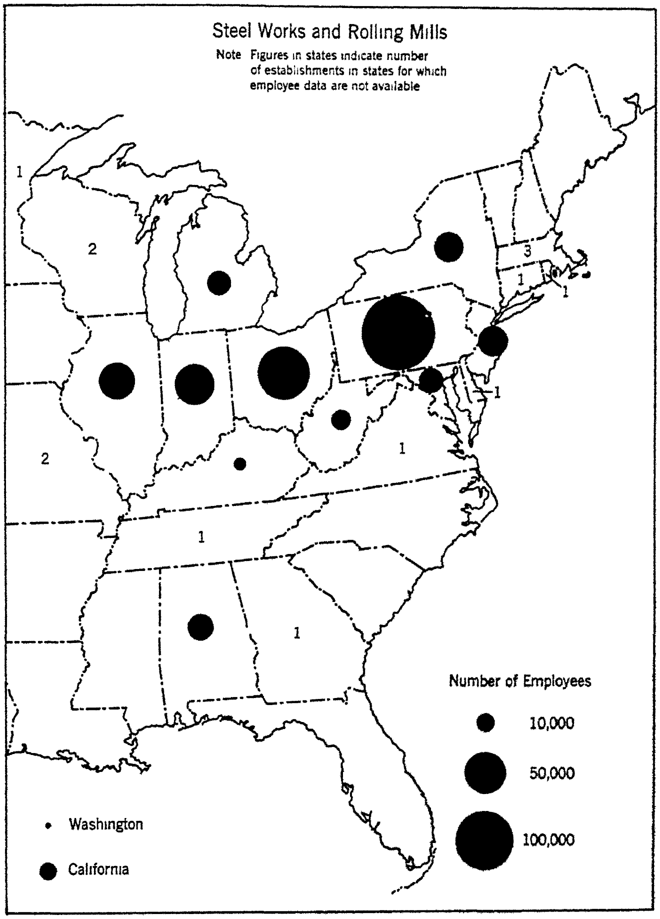
Steel Works and Rolling Mills
Note Figures in states indicate number of establishments in states for which employee data are not available
1
2
2
3
1
1
1
1
1
1
Number of Employees
10,000
50,000
100,000
Washington
California

Fig. 104. More than two-fifths of the net-value of the output of blast furnaces, and iron and steel mills is contributed by the Lower Lake Region, and more than four-fifths of the iron ore produced by the United States annually comes from the Upper Lake Region.

used, viz., charcoal, anthracite, and coke. The coke period brought the Lake Superior region into prominence. Previous to 1855, charcoal was dominant and furnaces were scattered widely to meet local needs, as in the case of the old sawmills and gristmills. Between 1855 and 1875 anthracite led. Since a small area in northeastern Pennsylvania had all the fuel, was able to make large quantities of iron, and was near the New York and Philadelphia markets, the first opportunity for leadership in the United States iron industry was offered and the first great producing center was established there. In 1870 half of all the pig iron was made with anthracite, but by 1910 this ratio had declined to 2.4 per cent.

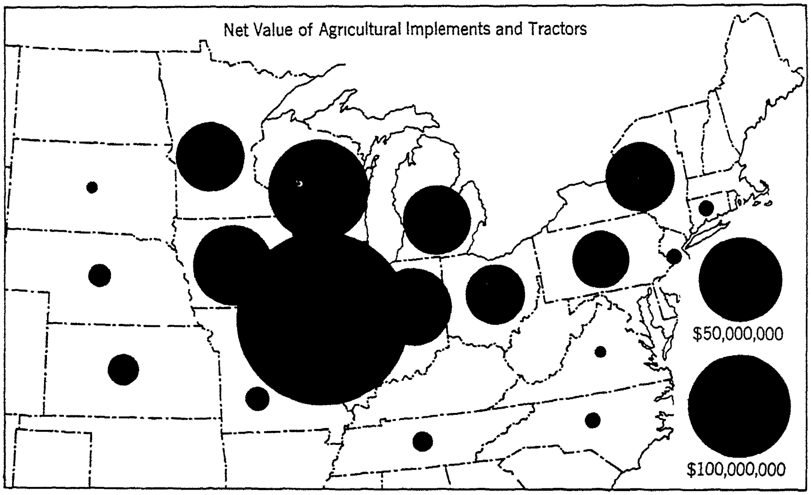

Fig. 105. Measured by net value, seven-tenths of the agricultural implement industry is situated in the Great Lakes States.

By 1875 the greater efficiency of bituminous coal and coke in this industry had been demonstrated. The most important supply of coal and coke lay west of the Appalachians, as did the iron ore and limestone; hence before 1880 the industry had shifted to western Pensylvania. The introduction of the Bessemer process led to rapid development, and by 1880 the best local ores had been used. Nearness to Lake Erie and cheap lake transportation made it impossible for the lean ores of western Pennsylvania to compete with the high-grade ores from Lake Superior; hence by 1883 western Pennsylvania produced more pig iron than any other district in the United States. Pittsburgh could not avoid becoming an iron and steel center. It commanded Lake ores and the best of coke from nearby centers, and had good transportation facilities by water and rail, natural gas, an established eastern market, a rapidly growing interior market, and a local market produced by the growth of allied industries. For more than half a century these advantages have made Pennsylvania the leading iron- and steel-making state.

Since enormous quantities of heavy raw materials such as iron ore, coke, and limestone must be brought together in the iron and steel industry of the country, it is evident that efficient low-cost transportation is a very imporant factor in plant location. With development of an efficient railroad system and the conversion of coal to coke at the steel mill where the by-product gas may be used for power, the Lake shores have become focal points at which the greatest economies could be effected, and the industry has shifted in that direction. Here are such centers as Duluth, Milwaukee, Chicago, Gary, Toledo, Cleveland, Lorain, and Buffalo (Lackawanna). Other large producing mills are in the Youngstown, Ohio, district, which has about the same advantages as Pittsburgh. Today the Lower Lake Region has more than one-third of the steel works and rolling mills of the country and produces more than two-fifths of the pig iron and the net value of steel works and rolling mills. As long as the Lake Superior district continues to be the major source of iron ore it appears likely that this region will continue to be a leading producer of iron and steel, as it provides for the assembling of abundant low-cost fuel, power, ore, and limestone, and an efficient railroad system makes accessible the markets of the Middle West and East. Abundant capital and both skilled and unskilled labor are available also.

The iron and steel industry itself has many branches and produces a multitude of products—blast furnaces, pipe mills, and rolling mills with their plates, sheets, structural steel, railroad rails, rods, etc. To hundreds of other plants the product of the steel mill is raw material. The products of these are legion, including cars, engines, automobiles, agricultural implements, ships, and the output of the foundry and machine shop. The production of agricultural implements is confined largely to the Lower Lake Region. Seven-tenths (net value) of the agricultural implements of the United States is produced here, and nearly two-fifths in Illinois alone (Fig. 105).

The Automobile Industry. The Lower Lake Region was formerly noted for its horse-drawn vehicles and for furniture. These industries arose and prospered in the midst of an abundant supply of hardwoods. Then came the invention and development of the automobile, and many of the carriage and wagon plants were converted into automobile factories. The production of horse-drawn carriages in the United States declined from about 2,000,000 in 1910 to about 10,000 a dozen years later. The rapid rise of the automobile industry is without parallel in industrial history. In the short period 1915–1930 it rose from eighth place among the industries of the country to first place. Today more than half (net value) the motor vehicles and equipment made in the United States is produced in the lower Lake region, and the industry has more than 700,000 employees. More than two-fifths of the output comes from Michigan (Fig. 106).

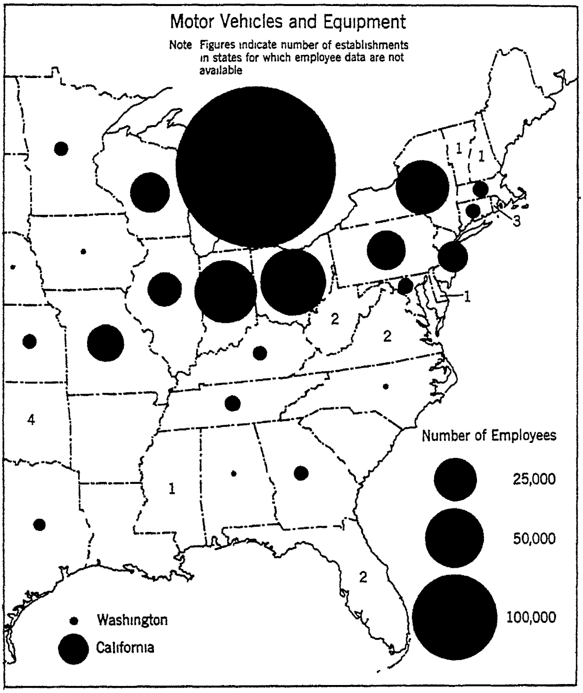
Motor Vehicles and Equipment
Note Figures indicate number of establishments in states for which employee data are not available
1
1
3
1
2
2
4
1
2
Number of Employees
25,000
50,000
100,000
● Washington
● California

Fig. 106. Motor vehicles, bodies, and parts. The motor-vehicle industry is centralized in the Great Lakes states, where more than half of the net value for the United States is produced. The dominant position of Michigan is a striking feature of the industry.

The growth of the industry in Michigan, and especially in the Detroit area, has been extraordinary, and its influence in turn no less so. In 1900, 39 per cent of Michigan's population was urban. By 1930 the urban population had increased to 68 per cent and the farm population had declined to 16 per cent. The population shift in these decades was due primarily to the rapid development of the automobile and allied industries. The populations of the leading automobile cities of Detroit, Flint, Pontiac, and Lansing increased at a rapid rate. The Detroit metropolitan area now ranks third in the United States in net value of products and in number of employees. The industry soon spread beyond the city bounds into the suburbs. Towns that were small rustic hamlets a few years before were converted into large modern cities, all of which depended, directly or indirectly, upon the motor-vehicle industry. Thousands of other people, not counted in the population of these cities, drove many miles daily to work in the factories. They came from the surrounding farms and villages over the paved highways that crisscross the area in a close network. Many of the farms for miles about these industrial centers produced foodstuffs for the rapidly growing urban population, and truck farming increased rapidly. Thus the whole cultural landscape of the motor-vehicle-manufacturing region has undergone a revolutionary change in a very brief period. However, large producing centers are not confined to Michigan. Cleveland, Toledo, South Bend, and Akron—the great tire center—are rivals.

The location of the industry in Detroit rather than in some other city is probably an accident. The city happened to be where it was first established on a mass-production scale. However, besides being the natural successor to the carriage and wagon industry and having the advantage of an early start, automobile manufacutring finds other favorable factors in the Lower Lake Region. This section affords cheap lake transportation for raw materials and for some completed automobiles and trucks; has some hardwood and an abundance of steel and other metals; has excellent railway transportation, as the main lines from East to West pass through it; and is near the center of population, which minimizes the cost of marketing a bulky product.

INDUSTRIAL CENTERS

Cities are the Epitome of Human Endeavor. Modern cities are the compendium of a mechanistic civilization. In prerailroad days, town sites were determined largely by the need of transshipment at foci of natural routes. Towns grew at natural junctions of land, river, and lake routes, at the head of navigation, at breaks in navigation, at fords, at the junction of navigable tributaries, and at points where there was a salient change in river direction. Such centers became the marts for all kinds of tributary products, and later the focal points for canals, highways, and railways. The larger environmental factors, such as climate, soil, power, minerals, and regional location, continue to function, but in most cases the factor that determined the immediate location has ceased to be of great significance. Chicago would probably continue to be a great city if the Great Lakes should cease to exist. The modern city is a complex unit of closely crowded humanity, a great railroad center, a great market, a center of skilled and unskilled labor, a great collecting, distributing, and manufacturing center with large-scale business organizations having great capital investments in established plants. Many of the large railroad, truck, and airline cities of today were the water-route cities of the prerailroad period. Three-fifths of the section's major cities are situated on navigable rivers or on the Great Lakes. All these cities are important railroad centers. River traffic has ceased to be of great importance, but the Lake traffic wields a large influence.

The Chicago District. Someone has aptly described Chicago as "the epitome and climax of the prairie and Lake region." Its immediate site was determined by the Chicago River, which served as a harbor and led by a low portage through the old outlet channel of glacial Lake Chicago, to the navigable Des Plaines and Illinois Rivers and thence to the Mississippi. At times of high water canoes passed from the lake to the Des Plaines without portaging. This route was followed by the Indians long before the advent of the white man. Far more important in the growth of Chicago has been its location near the southern end of Lake Michigan where the lake projects into a vast plains area whose continuity of fertility and productiveness is unequaled anywhere else in the world. Today nearly every important railway east of the Appalachian Mountains enters Chicago. All the main trunklines from East to West pass around the southern end of the lake and have their terminals in Chicago. All railroads from the Northwest make their connections there. No railroad passes through Chicago. It is also the focal point of the continental interior for air service. It has become a huge collecting, distributing, and manufacturing center. To it may be gathered all the manifold products of the Middle West: wheat from the Dakotas and Kansas; livestock from the Corn Belt and western grazing lands; iron ore and timber from the Upper Lake Region; and coal from Illinois, Ohio, and Pennsylvania. From it may be distributed with equal facility the products of its factories. The total number of people engaged in manufacturing enterprises within the city limits is greater than the total population of any one of nine states. From a city of 4400 people in 1840, it has risen to second place among the cities of the country in population and in the value of its manufactures. It has become the world's greatest grain, meat-packing, and railroad center, and one of the largest airports of the country. Its industries are large and varied and based chiefly on the raw materials of the region which it serves and supplying the demands of a dense population. Chicago is a product of the machine age, like most other American cities, and its accomplishments are measured largely by materialistic standards.

The Chicago metropolitan area, as defined by the census, extends from the north boundary of Illinois southward along the lake shore, including five counties in Illinois and one in Indiana, and has a population of

4,825,000. The population of this intensively industrial area is approximately the same as that of the state of Massachusetts, but the net value of its products is two-fifths larger. Into it has poured a rapidly increasing flow of humanity. Only seven states in the Union, other than Illinois, have as many people as are concentrated in this beehive of industry at the southern end of Lake Michigan. Chicago overshadows all other cities, but numerous other urban centers are located in the area, such as Gary, Hammond, Elgin, Joliet, Aurora, Evanston, and Waukegan. It is the focal point for the richest agricultural region of the size in the world, a region which is also equipped with an abundance of basic minerals such as coal, iron, copper, lead, and zinc, and the vast reaches of the level prairie land offer few obstacles to the development of transportation. The present producing and consuming population of its tributary area is scarcely a fifth that of a similar area in western Europe, but the potentials for an increased production of crops, domestic animals, dairy products, minerals, and forest products are very great. Today the metropolitan area is traversed by a close network of wide, paved highways over which thousands of trucks, buses, and passenger cars travel daily to serve the industrial and pleasure demands of the area and its extensive hinterland.

Industries of nearly every kind, designed to meet all human wants, are found among its 12,280 manufacturing establishments. Among the industries, turning out products having a net value of more than $100,000,000, may be mentioned meat packing, iron and steel and its allied industries, machinery, printing and publishing, petroleum refining, and food products. The net value of its manifold industrial products equals nearly half that of all New England, a fourth that of the Middle Atlantic States, and about a third that of the whole Lower Lake Region outside the metropolitan area. This value is exceeded by only one other industrial area, viz., the New York metropolitan area.

✓ Within the Illinois portion of the metropolitan area are located nearly three-fifths of the population of the state, three-fourths of the manufactures measured by net value, and a similar concentration of manufacturing employees. This great amassment of population has led to the development of jealousy and fear throughout the rest of the state—a fear of political domination by the large city. As a result, the democratic theories that representation in state government should be in proportion to population and that people should not be taxed without proportionate representation have been abandoned completely. Chicago has long been denied such representation in the State Legislature. All efforts to enforce the provisions of the state constitution so as to equalize representation have failed. That portion of the state outside Chicago is in power and it intends to stay in power. Even the State Supreme Court has ruled that the legislature cannot be compelled to carry out the law of the land and give Chicago its proportionate representation.

Closely associated with the Chicago metropolitan area are such urban centers as Milwaukee, Racine, and Kenosha, Wisconsin, with their extensive iron and steel, motor-vehicle, beverage, machinery, meat-packing, leather, and leather goods establishments, The industries of the whole district utilize the raw materials of the Middle West—agriculture, mine, and forest—and many products find their chief market there, e.g., farm machinery. All the principal centers put out a great variety of metal products. All have profited in the past by their location on Lake Michigan, and Gary, Milwaukee, and South Chicago depend upon it now for the delivery of Upper Lake ore. Though the lake commerce of Chicago and Milwaukee is of considerable industrial significance to them, it is relatively less so than formerly and is very small compared with the huge movement of commodities by rail and truck.

The Lake Erie District. From Detroit to Buffalo, at foci of lake and land transportation, have grown up a number of important industrial centers. These include the automobile city of Detroit, which is discussed elsewhere, Cleveland and Toledo with their iron and steel mills and automobile plants, and several lesser ones. The manufacturing industries of the Ohio counties bordering Lake Erie are confined largely to Cleveland and Toledo where iron ore of the north meets coal from the south. The net value of the manufacturing enterprises in these lake-border counties constitutes more than a third of that of the state of Ohio. From the lake shore centers, iron ore is distributed to many other Ohio iron- and steel-working cities, particularly in the Youngstown area.

River Industrial Centers. Though river traffic is no longer of paramount importance, many river cities have continued their growth with the development of railroad service. The largest of these is St. Louis, Missouri, with East St. Louis just across the Mississippi in Illinois. St. Louis is the fourth largest city in the North Central Section in population, and correspondingly large industrially. Situated near the confluence of the Mississippi and three other navigable rivers—the Missouri, Ohio, and Illinois—it occupied a commanding position when rivers were the principal means of transport. Its strategic commercial position naturally made it a focal point for railroads as they were extended westward. It was, therefore, enabled to maintain its commanding position in the Southwest. It occupies a central position in the producing areas of corn, wheat, cattle, and swine, and has become a marketing center for these products and a distributing point for the many commodities required by an agricultural population. Its industries are highly varied, and no one holds such a commanding position as do automobiles in Detroit or flour milling in Minneapolis. Meat packing is its leading industry, and it is the greatest boot- and shoe-manufacturing center outside of New England. Meat packing is the dominant industry of the Kansas City center and of Omaha, which, like St. Louis, are near the junction of the stock-food producing prairies and the western grazing lands. Other important meat-packing centers are South St. Paul, Minnesota, St. Joseph, Missouri, and Sioux City, Iowa. Iowa Iowa

Cincinnati, situated at a salient change in river direction and near the confluence of the historically important Miami and Ohio, is south of the steel-working cities of Ohio. It is tributary to the Bluegrass Region of Kentucky and productive agricultural lands at the north. In its early stage it was an important concentration point for settlers moving down the Ohio, and became a leading river port and later a railroad center. It was the leading livestock and meat-packing center until surpassed by Chicago in 1860, and that industry continues to be a leading one. Its other leading industries include machinery, men's and women's clothing, beverages, and chemicals.

Minneapolis-St. Paul, the "Twin Cities," at the head of Mississippi navigation, are independent political rivals but essentially one continuous urban center. Minneapolis arose as a lumber city at the Falls of St. Anthony. With the decline of lumbering, the advance of settlers into the fertile lands of the Northwest and the production of wheat, the power of the falls was utilized to operate great flour mills. Flour milling continues to be one of the major industries,measured by net value of product. But flour milling is largely an automatic process; the value of the raw material—wheat—is relatively high, and few men are needed to turn out a finished product of high value. The net value of the city's flour mills constitutes only a small part of that of its many industries, and the mills employ a correspondingly small number of all persons engaged in manufactures. St. Paul arose when the Mississippi was the great highway to the Northwest. It was then the end of the boat journey. Today boat traffic on the great river is small. St. Paul is largely a wholesale distributing center—a huge warehouse—for the Northwest. It has no outstanding industry but ranks high in many, among which are meat packing (South St. Paul), machinery, paints, paper, and printing and publishing.

The industries of both cities have far outgrown the available water-power resources, and coal must be brought by lake and rail.

THE ST. LAWRENCE-GREAT LAKES SEAWAY PROJECT

The St. Lawrence project is intended to eliminate barriers to deep draft vessels that now exist between the Great Lakes and the Atlantic.

The major barrier is the rapids of the St. Lawrence around which there is now a narrow, 14-foot canal. The proposed Seaway will have a minimum depth of 27 feet throughout 2347 miles, from Duluth to deep water of the Gulf of St. Lawrence. Estimates indicate that the route is now approximately 90 per cent complete. The Welland Canal now overcomes the 324-foot difference in level between Lakes Erie and Ontario.

The growth of agriculture, manufacturing, transportation—in fact, the whole cultural landscape of the Great Lakes Region—has been profoundly influenced, directly or indirectly, by the availability of Lake Superior iron ores and the movement of goods on the Great Lakes. Near exhaustion of the high-grade ores of Minnesota and Michigan has stimulated interest in the Seaway. Such exhaustion necessitates a low-cost method of utilizing the low-grade taconite ores, a new source of high-grade ore, or possible shifting of the steel industry to tidewater where foreign ores may be obtained.[1] Foreign sources would probably include Labrador, Newfoundland, Brazil, Cuba, and Venezuela. The Adirondack region could supply a few million tons, but the production capacity is inadequate to meet the needs of the steel industry. It is probable that Labrador will be the major source of high grade ore for midwestern steel mills. However, that depends upon completion of a Seaway sufficiently large to handle the traffic. It is estimated that the Seaway will carry approximately "30 to 37½ million tons of iron ore, 6½ to 11½ million tons of grain, and about 4 million tons of bituminous coal." With the development of the oil fields in western Canada there is likely to be a considerable traffic in oil. These estimates do not include a possible expansion of foreign trade and of local traffic. The bottleneck is likely to be created by the limited number of vessels that can be passed through the Welland Canal in a 24-hour period.

A RURAL-URBAN UNIT IN OHIO

From among the many areas that might be selected as typifying the eastern portion of the North Central States, Marion County, Ohio, has been chosen as representative (Fig. 107). The county lies near the eastern margin of the Corn Belt, just northwest of the center of Ohio and about 45 miles from Columbus. Its surface features are strikingly uniform—with an elevation range of only 200 feet—as it occupies a part of the broad, smooth-to-gently undulating glacial plain that forms the divide between the Ohio and Great Lakes drainage basins. The local elevation differences are due to stream erosion, but the slopes are sufficiently gentle to be used for agricultural purposes, and very few are steep enough to erode seriously. Nearly nine-tenths of the entire area is mantled with fertile, silty clay loam derived from the glacial drift.

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[1] This trend is indicated by the proposed steel mill at New London, Connecticut, and the new mill at Morrisville, Pennsylvania, both of which will depend primarily upon imported ore. The large, fully integrated mill at Morrisville has an annual capacity of 1.8 million tons of ingots. Its ore will come chiefly from the Cerro Bolivar deposit in Venezuela.

The climate is healthful, invigorating, and favorable to crop production. The mean summer temperature is 72°, and the growing season averages 152 days in length. Nearly three-fifths of the annual rainfall of 38.5 inches comes during the spring and summer months, and a winter snowfall of 26.5 inches usually provides ample protection to winter wheat.

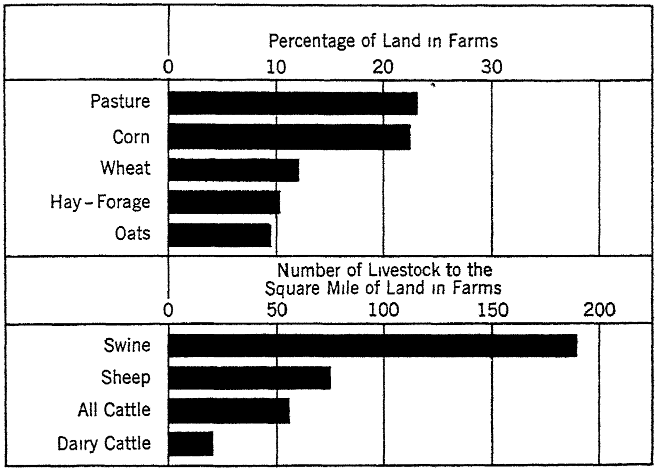


Fig. 107. Utilization of the land in Marion County, Ohio.

The first immigrants came from Virginia, Pennsylvania, New York, Kentucky, and New England, and were largely English, with some of Dutch, Irish, and German ancestry. These first settlers made their homes in the southern part of the area in 1806–1815, and by 1821 the population had grown sufficiently to organize the county. In 1950 the area had a population of 49,900, nearly seven-tenths of which lived in the city of Marion. The city of Marion, located near the center of the county, occupies a commanding position, and has nearly nine-tenths of the urban population. The present farm population averages 17 to the square mile of land in farms, even though it has decreased since 1930. Today the area has the appearance of a mature and thriving community with its farm homes and other buildings well built and well cared for and its economic, social, and political life centered on one large urban community. More than nine-tenths of the farm homes have electric service and radios, more than half have telephones, and two-fifths have running water. There are many more tractors and automobiles than farm operators. This is an area in which so-called advantages of urban living are widespread. More than nine-tenths of the land area of the county is in farms, and only about 6 per cent of the land area is woodland. The average value of land, buildings, machinery, and livestock is $17,450 a farm, and four-fifths of the farms are operated by owners and part owners. Highly developed means of transportation are available, as railroads traverse all parts of the area, most of the highways maintained by the county are hard-surfaced, and all the state highways in the county are paved. Educational facilities are excellent. Rural townships maintain centralized schools which are housed in modern brick buildings.

Agriculture. The higher lands, which were originally covered by virgin hardwood forests, were the first to be cleared and cultivated. Not until later years were the lower treeless and swampy lands reclaimed and farmed. The early farm products were much the same as are produced today, except that the area devoted to each has changed relatively. Shipments from Marion (city) in the 1850's included wheat, corn, oats, clover seed, wool, cattle, swine, sheep, horses, and hay. Since then the relative acreage of corn has increased, and the wheat acreage has decreased proportionally. Nearly seven-tenths of the cultivated land now produces corn, hay and forage, oats and wheat, and nearly a quarter of all land in farms is devoted to pasture. Present-day agriculture consists of general farming combined with stock feeding. Wheat, soybeans, cream, butter, chickens, and eggs are the principal products yielding a cash income. Though numerous other crops are grown they occupy a very minor position. Potatoes, small fruits, and orchard fruits are raised chiefly for home consumption but with a small surplus for local markets.

The feed crops are converted into cash through the medium of stock feeding on the farms. There are 64,700 hogs, 18,800 cattle, and 25,700 sheep in the county, or an average of more than 280 animals to the square mile of farm land, exclusive of horses and poultry. More than three-fourths of the farm income is derived from the sale of livestock and livestock products. Many of the beef cattle and sheep are feeders shipped from western parts of the country to be fattened for the market. They are usually imported early in the season, and kept on the pastures through the summers. In the fall the cattle are turned into the corn fields or are fed shelled corn, silage, and other fattening foods; the sheep are placed in the stubble fields from which the wheat has been harvested, or in the corn fields. Both animals are later put in prime condition by more intensive feeding. The swine are raised in the area, pastured during the summer, and fattened chiefly on corn in the fall and winter. The fattened stock is shipped to market in Marion, Columbus, Pittsburgh, Cleveland, Buffalo, and Chicago.

The agricultural industries of Marion County are conducted on what is commonly called the "extensive-pasture scale," with a minimum of soiling to supply additional feed. Most of the feeding is done in the open, and there are comparatively few covered feeding grounds or sheds. Dairying is of local importance, especially around the city of Marion and about some of the villages where creameries have been established.

Urban Centers and Manufacturing. Marion, located near the center of the area, is the leading city, and its population of 33,800 comprises nearly seven-tenths of the county's total population. Each of the seven other municipalities had a population of less than 1000 in 1950. Marion has superior transportation facilities, as many railroads and many hard-surfaced and paved highways radiate from it in all directions, giving access to all the principal markets of the country. It is a prosperous manufacturing city whose major industrial plants produce steam shovels, road rollers, engines, threshing machinery, conveyors, alloy steel, brass and malleable castings, steel bodies for automobile trucks, and iron and steel beams. Among other important products and industries are rubber tires, lime, meat packing, flour mills, and woodworking. Its factories give employment to more than 95 per cent of all the manufacturing employees in the county. The net value of its products exceeds $35,800,000, which is approximately five times the gross value of all farm products produced in the county. The city affords a good market for a large, easily accessible territory, and adjacent farm land has considerably higher value than the average for the county, which was $143 an acre in 1950.

PROBLEMS

1. Does the Great Lakes-to-Gulf project or the Great Lakes-St. Lawrence project offer greater permanent value to the North Central States?
2. Will completion of either project named in Problem 1 materially increase the commerce of the Great Lakes?
3. Will Duluth, Chicago, or Buffalo profit most by completion of the Great Lakes-St. Lawrence project?
4. Will completion of either or both of the two Great Lakes-to-sea projects enable the North Central States to attain a higher material development than any other section of the country?
5. Will the North Central States become the leading manufacturing section of the United States?
6. Resolved: That the Lower Lake Region possesses greater advantages as a home for man than does any other equal area of North America.

7. Will the Lower Lake Region become the leading iron- and steel-manufacturing section of the United States?

8. Will agriculture or manufacturing be the leading industry in the Lower Lake Region?

9. Will Chicago maintain its position as the leading city of the North Central Section?

10. Will the lower Lake Region ultimately have a populaiton as dense as that of the Middle Atlantic States?

CHAPTER 10

North Central Section—The Upper Lake Region

A Region of Extractive Industries. The Upper Lake Region includes northeastern Minnesota and northern Wiscosin and Michigan. Its southern boundary is a broad transition zone of cut-over forest land. Human occupancy on the south has led to an advanced stage of land utilization, as previously described. On the north the land and living conditions are largely primitive or frontier in character, except in local areas. All its industries are extractive in character; it is a land of exploitation. Its long, cold winters, with heavy snowfall; short, cool growing season; abundant rain; and thin sandy loam soils have been conducive to coniferous and to mixed forest growth but unfavorable to agriculture. The ancient sedimentary and crystalline rocks have provided exceptionally rich deposits of iron and copper, and the Great Lakes have provided cheap transportation to eastern and southern markets for the products of mine and forest. As the great continental glaciers moved over the region, the less-resistant rocks were gouged out and the glacial drift was distributed unequally over the land surface, forming thousands of deep lake basins; the shallower basins thus formed became swamps and muskegs. The region probably has at least 10,000 lakes in the virgin forest and cut-over lands, many of which are being developed as summer resorts—the most recent phase of man's utilization of the natural resources.

IRON MINING

Significance of the Iron Deposits. Iron-ore deposits situated like those of the Lake Superior district, of such high grade, in such a limited area, and so easily mined on a large scale, could not fail to affect the whole nation. Their extraction has been the chief industry of the Upper Lake Region for many years, having far exceeded forest exploitation in importance. The average yearly output of the mines varies from three-fourths to more than four-fifths of the entire ore production of the United States and nearly half that of the world. Only three mines in the

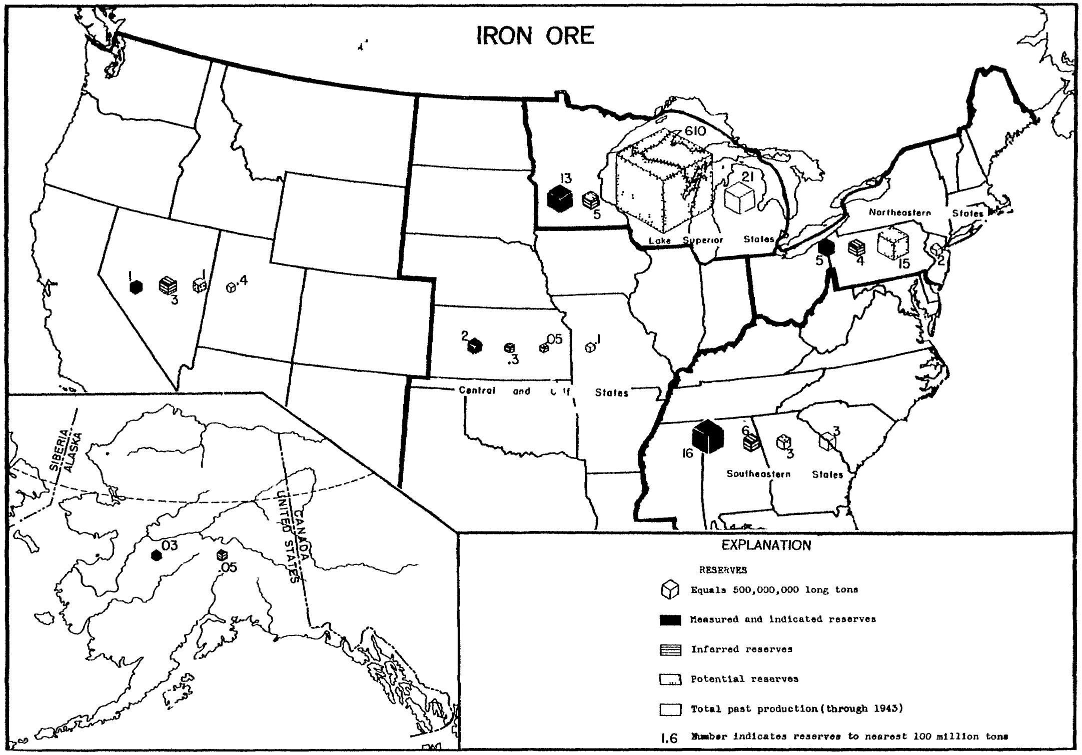


Fig. 108. Iron in comparatively small quantities is produced in numerous localities, but three-fourths to four-fifths of the annual production comes from the mines of Minnesota, Wisconsin, and Michigan in the Lake Superior district. *Courtesy, U. S. Geological Survey and Bureau of Mines*

United States outside the region produce more than 1,000,000 tons each annually, and the usable ore output of one mine in this region is twice that of any other iron-mining district. The use of these ores also accounts for the growth of population in the region, the growth of numerous Lake cities, and the rapid growth of the steel industry and its many allied industries. They have, therefore, had a profound influence upon the whole country.

The Iron-Ore Fields. The Lake Superior ore district consists of five principal ranges: the Marquette and Menominee in Michigan; the Gogebic in Michigan and Wisconsin; and the Mesabi, Vermilion, and Cuyuna in northeastern Minnesota. The annual production of ore is now 80 to 85 million tons. The Mesabi and Vermilion are 60-90 miles northwest, and the Cuyuna about the same distance west and south, of Duluth-Superior and Two Harbors, from which the ore is shipped to lower Lake ports. The Marquette Range is near the city of Marquette, the Menominee Range near Escanaba, and the Gogebic Range 25–50 miles from Ashland. Thus each range has an adequate outlet by water, a factor of great significance in its development.

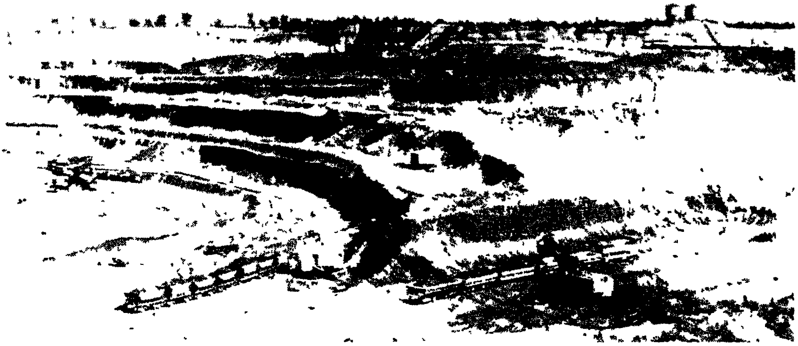


Fig. 109. A part of the Hull-Rust open-pit mine on the Mesabi Range in Minnesota. *Courtesy, Oliver Mining Co.*

Iron ore was discovered on the Marquette Range in 1844, and the first ore was taken from the region the following year. During the succeeding 8 years, efforts were made to smelt the ore with charcoal fuel, but the iron could not be marketed in competition with that of the steel mills of the East. In 1853 the first shipment of consequence was made to Sharon, Pennsylvania, where the first real test of the ore was made. The ore proved to be of such high grade that a demand for more was created.

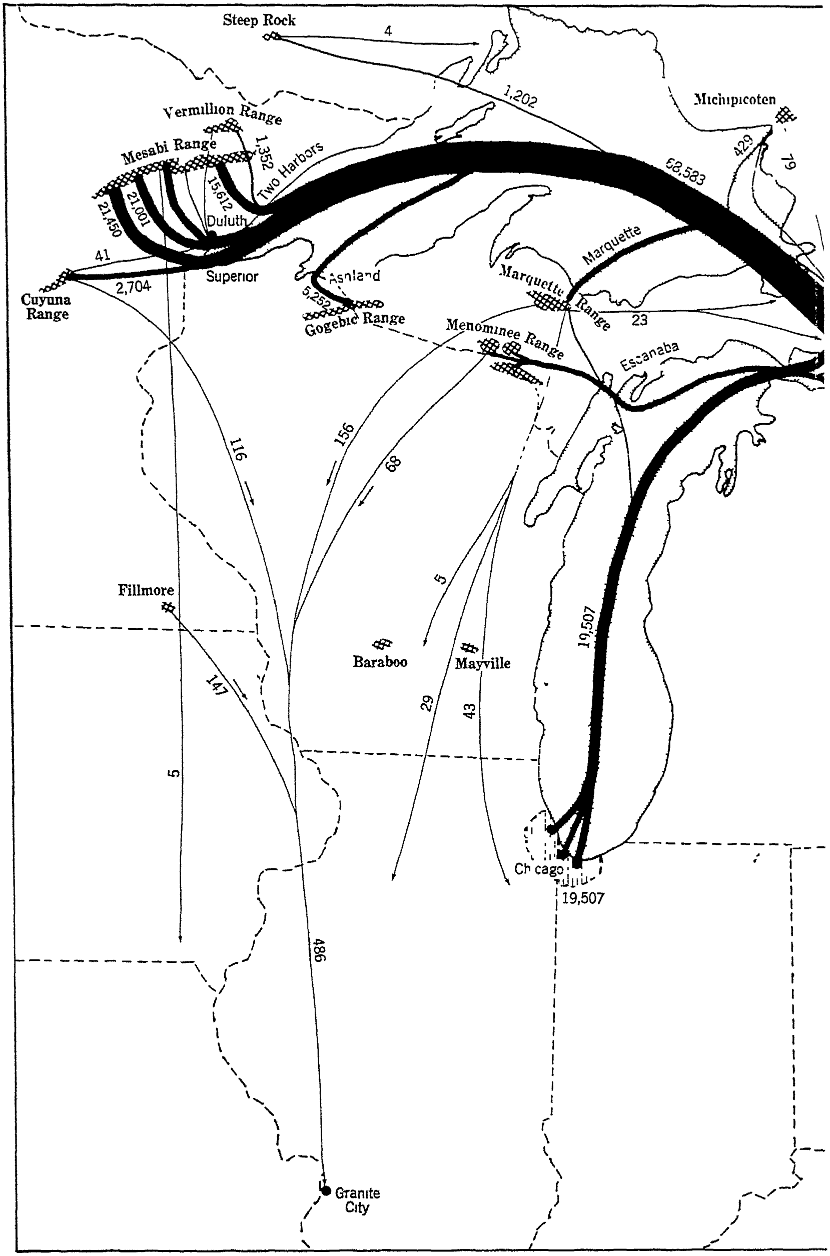
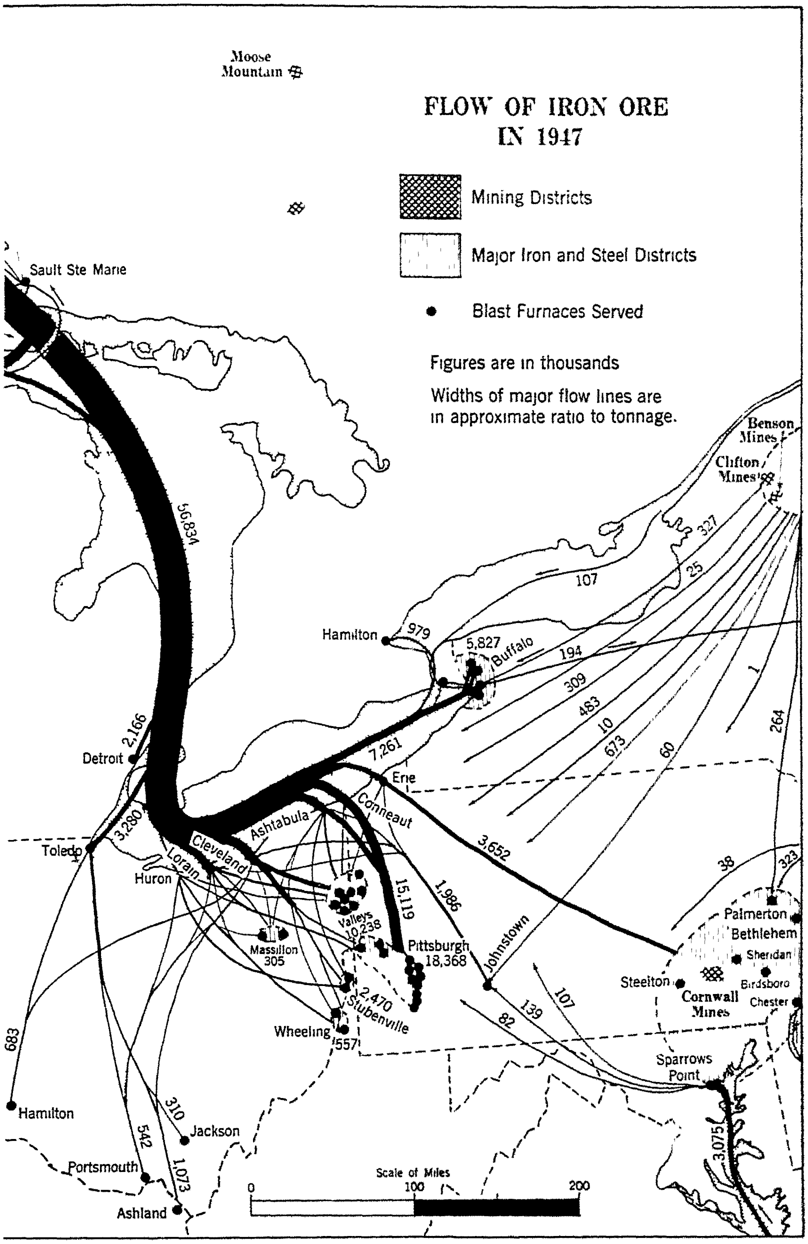


Fig. 110. Flow of iron ore with mining districts, major iron and steel



districts, and blast furnaces served. *Data from Lake Superior Iron Ore Association.*

Progress, however, was slow for a time. The ore deposits were in an unbroken forest, 14 miles from the shore of Lake Superior, and without suitable means of transport; they had to be portaged around the Saint Marys Rapids and reloaded; the lake vessels were few and small; the ore had to be introduced into the market; and many of the iron workers were reluctant to experiment, as some had declared the ore useless. However, the opening of the Sault Canal and the demand for iron created by the Civil War resulted in a rapid increase in production. The Marquette Range had no competition until 1877, when the first shipment of importance was made from the Menominee Range. Though the presence of other ore was known in the early 1850's, production of importance awaited transportation facilities. The Gogebic and Vermilion Ranges then rose rapidly into the million-ton class.

The first ore pit in the Mesabi Range was made in 1890. Other discoveries of rich ore followed rapidly. In 1892, 29,000 tons were produced, the next year 2,000,000 tons. Since then the production of the Mesabi Range has been phenomenal. From it has come nearly two-thirds of all the ore ever mined in the Upper Lake Region. In a single year the output has exceeded 70,000,000 tons, and its yearly average is about four times that of any foreign country. It continues to produce more than half of the annual output of the United States; two-thirds of that of the Lake Superior district; and one-third of the world' annual production.

The Mesabi iron deposits are covered thickly with glacial drift, but when this has been removed great ore bodies of large horizontal extent, compared with their thickness, are exposed. This ore is a soft, porous, brown, red or blue hematite of high grade, and varies from a finely powdered to a compact mass. These conditions make possible low-cost, open-pit mining with power shovels, as the ore is loaded directly onto the railroad car in the mine. Estimates of merchantable ore indicate reserves of nearly a billion tons, and many times that amount for ores not available under present market conditions. The Mesabi has become of paramount importance in the country's iron and steel industry and the world's greatest iron producer, for a number of reasons: (1) The ore is of high quality. For many years, most steel was made by the Bessemer process, which demanded high-grade, non-phosphorous ores. Much Lake Superior ore met these conditions and, once on the market, the demand for this ore grew rapidly. (2) Cheap mining methods are possible in most places. The character of the deposits made possible open-pit, power-shovel mining on the Mesabi and comparatively cheap mining on some of the other ranges. The low cost of mining on the Mesabi is probably not equaled anywhere else in the world. (3) Transportation methods by water and rail and mechanical devices for handling the cargoes have been so improved that the handicap of distance between the coke and ore has been nearly overcome. (4) The commercial and industrial development of the country has created an unprecedented market for iron and steel products. (5) The concentration of industries under the management of large corporations has made possible the expenditure of great sums in perfecting methods of mining, transportation, manufacture, and in the elimination of waste.

The iron-ore reserves of the Upper Lake Region are large, though about 2,500,000,000 tons have been removed. The reserves of high-grade ore available under present market conditions are estimated to be more than 1,800,000,000 tons, an amount sufficient for about 15 or 20 years if the present rate of production could be maintained. The low-grade reserves—similar to many ores used in Europe—are approximately thirty-five times the high-grade reserves, and if they can compete with the low-grade ores of the East the industry can survive for many generations. Otherwise much of the mining region will probably revert to forest and the now thriving cities will become ghost towns. Competition promises to be difficult, as the agriculturally controlled legislature of Minnesota tends to place an increasing tax burden upon iron ore, in addition to other local taxes.

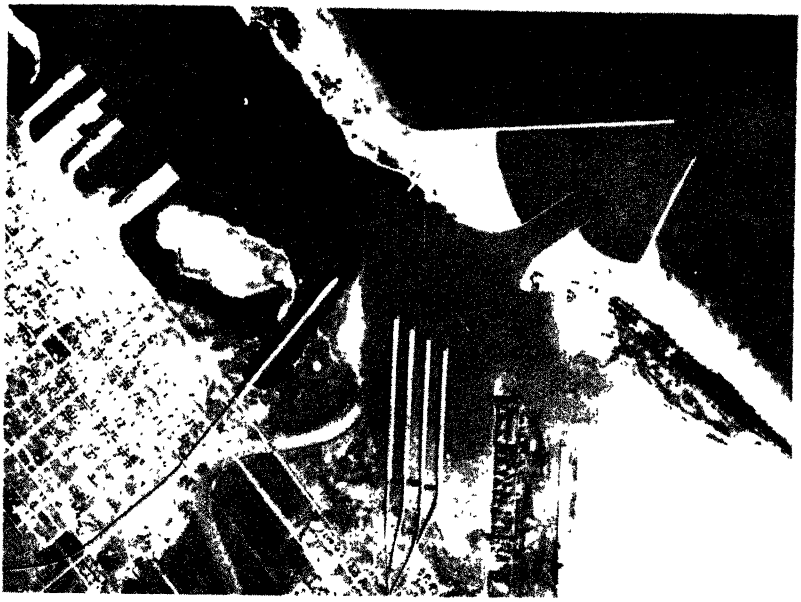


Fig. 111. A small part of the Duluth-Superior harbor showing a few of the docks. *Courtesy, U. S. Marketing and Administration Service.*

Iron Ore and Great Lakes Commerce. As late as 1845, Lake Superior commerce was largely in furs, and one horse hauled all the freight that passed around St. Marys Rapids. The ground scarcely had been broken for copper and iron mining. When the Sault Canal was opened ten years later the traffic amounted to 14,500 tons a year. The growth of commerce was rapid, and the canal was enlarged several times in succeeding years. More than 110,000,000 tons of freight now pass through the canal annually, more than seven-tenths of which is iron ore, and nearly one-sixth is coal carried in returning ore boats to supply the Northwest. The eastbound ore and the westbound coal constitute nearly nine-tenths of the traffic. Since these two commodities form a very large part of the Great Lakes commerce, it is evident that the commercial prestige of the Great Lakes depends upon the northern iron mines. The water route, steel vessels of great capacity, cheap fuel, coal as a return cargo, the Sault Canal, river and harbor improvements, the growing demand for ore, consolidation of management, and the extensive use of modern machinery, all have contributed toward producing the lowest freight rates in the world for similar service.

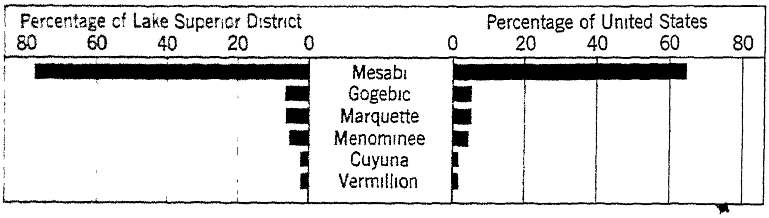


Fig. 112 Relative production of iron ranges in Lake Superior district, 5-year average. From 1930 to 1953 annual *shipments* averaged 84,150,000 tons.

Development of City Centers. Iron mining has wielded a strong influence in the growth of three classes of city centers, viz., the mining, shipping, and receiving centers. A cluster of houses and stores soon followed the opening of mines, and upon the latter the prosperity of the village depended. To this group belong such places as Hibbing, Virginia, Eveleth, Ironwood, Iron Mountain, and Ishpeming. To the ore-shipping group belong Duluth-Superior, Two Harbors, Ashland, Marquette, and Escanaba; and to the receiving class, such centers as Chicago-Gary, Detroit, Cleveland, Toledo, Lorain, and Buffalo. Since nearly all the ore mined leaves the Upper Lake Region, the influence of iron and steel manufacturing is felt only indirectly in the region.

The growth of the shipping and receiving cities is in striking contrast. The shipping cities are distinctly the *transfer* type, and the goods pass on to some other center for fabrication or distribution. The receiving cities are distinctly *distributing* and *manufacturing* centers and have far surpassed the others in size. Duluth-Superior would have considerable importance without the iron mines. They lead all the other Upper Lake cities in growth, diversified interests, and possibilities, because of (1) strategic position at the head of Lake Superior, (2) commodious, landlocked harbor of 360 acres, (3) water power from Saint Louis Falls, (4) cheap coal by returning ore boats, (5) abundance of iron ore, (6) rich though distant agricultural hinterland, (7) and an increasing market to the south, west, and northwest. Duluth now has the only steel mill of importance north of the Lower Lake Region, but nearly all other industries are based on things other than iron and steel. Although the lumber, grain, and flour-milling industries have been of much importance, the influence of the iron mines has been even greater. The development of allied iron and steel industries is yet to come, with further development of the northwestern hinterland.

COPPER

Pure metalic copper occurs in the Keweenaw Peninsula of Michigan and was worked by the Indians before the advent of the white man. Mining by the white man began in the 1840's, and for many years Michigan was the leading copper-producing state. Though huge quantities of copper have been taken from the mines and though it is now more than a mile from the entrance of some of the mines to the farthest workings, and the costs are high compared with other copper mining districts, Michigan ranks sixth as a copper producer. The ore is reduced, and the copper made ready for commercial use, near the mines. Local reduction of the ores is favored by the low-cost coal brought to the mills by returning iron-ore vessels. However, the production of 20,000 tons is insignificant compared to that of Arizona and Utah, and very small compared to Montana, Nevada, and New Mexico. Like iron, copper is converted into its many industrial uses in other parts of the country and hence contributes little to the development of this region, except in the mining and local concentration processes.

FORESTS

This region was originally forest covered, with such valuable trees as the white pine, hemlock, spruce, fir, beech, and maple. Abundant rainfall and cool summers produced a splendid growth. The heavy winter snows and the ice-covered rivers and lakes favored exploitation when the lumberman had exhausted the easily accessible forests of New

England and moved westward. The Michigan forests were the first to be attacked, and Michigan led in production for a number of years, followed in turn by Wisconsin and Minnesota. The lumberman then moved on to the forest of the South and is now attacking those of the Pacific Coast. Michigan, once a leading lumber-producing state, can no longer supply its own needs, and thousands of acres once covered with splendid forests now present a scene of desolation. Today only a small fraction of the magnificent stand of original forest remains in the Upper Lake Region. A few mills are still operating, and lumbering and pulp making are still leading industries, but the quality of many of the logs being sawed is far below that of former years. Traveling across the district, one is confronted by mile upon mile of cut-over and burned-over forest lands, with here and there a clearing where some hardy pioneer is endeavoring to make a living by agriculture. One must now penetrate areas remote from transportation routes to find an undisturbed virgin stand of any considerable size.

AGRICULTURE

Some of the cut-over land is suited to agriculture, and probably 40,000,000 acres in the Lake States as a whole is best adapted to forest growth. Properly planted and protected from fire, this acreage can be made to produce an annual tree crop of great value. It seems probable that, with the exhaustion of the iron and copper, a forest growth with agriculture interspersed on the more fertile areas, supplemented by work in the lumber camps during the winter months and the expansion of the summer-resort business on its many lakes, will be the future of the Upper Lake Region. With such agriculture can go livestock and the dairy industry. At present agriculture depends chiefly upon the mining and resort centers for a market. These will continue to be the market for some years, but ultimately the agricultural products must be in a form to stand the cost of transportation to more distant consuming centers.

A LAKE REGION TRANSITION UNIT

In the broad transition zone between the undeveloped northern part and the highly developed southern part of the Great Lakes Region are numerous unit areas that typify the evolution of the Lake country as the home of man. From among these areas, Outagamie County, Wisconsin, which lies south and west of Green Bay and north of Lake Winnebago, has been selected. Historically, it is one of the oldest traversed sections of Wisconsin, as its principal river, the Fox, was followed by Indians and early explorers in passing from Lake Michigan to the Wisconsin and Mississippi Rivers. Only 51 years after the Pilgrim Fathers landed at Plymouth, Pére Allouez founded a mission at De Pere where the first rapids of the Fox are encountered in the ascent from Green Bay. The first white settler in Outagamie County located near the present city of Kaukauna about 1790, the year after Washington became the first president. In 1843 a colony of Dutch immigrants settled at Little Chute, and the first homes were built in Appleton the same year. Fur trading was the chief occupation until about 1840, but soon thereafter began the rapid removal of the pine and hardwood forests and the expansion of agriculture and other industries. The Fox, improved by canals and locks, continued to be the principal means of transportation until the arrival of the railroads about 1860. Today the splendid forests of pine, maple, beech, oak, hemlock, and ash are gone; more than nine-tenths of the land is in farms; the farm population averages 26 to the square mile of farm land; fine, modern farm homes dot the landscape; more than 150 manufacturing establishments are in operation; and many miles of railroads, and hard-surfaced and paved highways give adequate avenues of transport. As imagination takes one back to the wilderness days of the hardy fur trader, explorer, and intrepid missionary, the change seems remarkable, yet the evolutionary process has required more than 2½ centuries since that first Mission was established on the Fox. At first a land of exploitation, this area has become a land of permanent homes and has attained a substantial basis of human economy in comparatively recent years. It may be described aptly as old, yet new, as its substantial development represents a comparatively recent stage in man's northward migration.

Surface and Soils. The area is typical of a glaciated region, as it lies within that part of Wisconsin covered by the Green Bay Lobe of the continental ice sheet. About two-thirds of the county, comprising the central, southern, and eastern parts, is covered by glacial drift. Its rolling surface consists of low hills and shallow basins distributed without definite relation to drainage lines. Many of the low, marshy basins have been drained artificially. Numerous nearly level areas that lie somewhat below the general level of the surrounding land have soils of lacustrine or outwash origin. Along the Wolf, Shioc, and Embarrass Rivers in the northwest is an extensive belt of gently undulating to nearly level alluvial soils and large areas of poorly drained peat marshes. These sluggish, meandering streams overflow large areas bordering their channels.

More than four-fifths of the county is covered by loam soils which vary from fine sandy loam to clay loam. Considerable areas in the Fox River Valley have red clay soils which were deposited in the quiet waters of Lake Michigan when it stood at a higher level. The extensive belt of glacial and lacustrine soils, which extends across the central portion of the county from northeast to southwest and embraces the greater part of it, has a red clay subsoil which acts as retainer of soil moisture. This belt produces all the common crops and supports many fine farms.

All the numerous streams find their way directly or indirectly into Lake Michigan. The historic Fox crosses the southeastern corner of the county in its course from Lake Winnebago to Green Bay. It flows in a gorge 50–60 feet deep between banks of red clay and can be dammed without flooding adjacent farm lands. Lake Winnebago acts as a natural reservoir regulating the flow of the river so that it is affected but slightly by drought or by heavy rains. Within a distance of 9 miles the Fox has a fall of 134 feet and 5 rapids, each of which has determined the location of an urban manufacturing center, the leading ones being Appleton and Kaukauna. These rapids, together with three others in the Lower Fox, constitute one of the best water-power units in the state. The water power is now well developed and it has been a very important factor in making the Fox River Valley a large pulp and paper producer and one of the leading manufacturing centers of Wisconsin.

Climate. The climate is representative of east-central Wisconsin. It is healthful, invigorating, and favorable to a mixed farming-livestock type of agricultural economy. The winters are long and severe. Temperatures of −20° are frequent, but temperatures below 0° rarely continue for more than a week at a time. The snow cover commonly remains from December to March and protects the winter crops of wheat, clover, and alfalfa. The summers are short and mild. Maximum temperatures of 100° occur, but such extremes are rare and hot periods seldom extend through more than a few days. The annual precipitation of 32.6 inches is ample for all needs, as about two-thirds comes during the growing season of 140–150 days.

Agriculture. Agricultural development began first along the Fox, as that was where the first settlements were made and where the forests were first cleared away. Following closely the lumberman as he advanced farther and farther into the wilderness, the pioneer farmer cleared away the stumps and established his small farmstead near the margin of the great expanse of cut-over land. These early settlers grew wheat, corn, potatoes, hay, and root crops for local use. Essentially all the merchantable timber has been removed, and most of the region is now under cultivation. Though 90 per cent of the county is in farms only 64 per cent is in cultivated crops which represents a marked increase since about 1930. More than 38,000 acres are not included in farms and are undeveloped. These are in part cut-over land, and low, wet lands, chiefly in the northwest.

During the long history of the region there has been no marked change in the kinds of general farm crops grown, but the relative importance of some has changed greatly in the last half century. During the period from 1880 to 1950—for which cansus data are available—the proportion of improved farm land devoted to corn and barley fluctuated slightly, and the proportion devoted to oats made a substantial gain, thus indicating a strong tendency toward their permanent retention in the agricultural system. At present 3 crops dominate the agricultural economy. More than seven-tenths of the cropland is devoted to hay, oats, and corn. In addition more than 111,000 acres are used for pasture. An average of 206 domestic animals, exclusive of horses and poultry, is now maintained to the square mile of farm land.

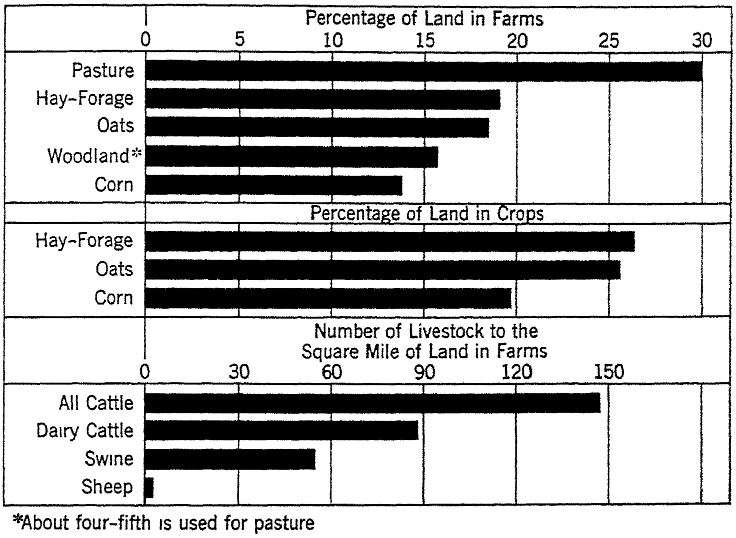


Fig. 113. The use of land in Outagamie County, Wisconsin.

Present-day agriculture consists of intensive production of stock feed, and dairying. More than a quarter of the cropped land produces hay and forage, more than two-thirds of which consists of cultivated grasses such as clover and alfalfa. A quarter of the crop acreage is devoted to oats, and about a fifth to corn and other feed crops. Practically all crops yield an income. Some are sold directly from the farm, but most of the hay, forage, oats, and corn are fed to livestock and reach the market as dairy products, pork, and beef.

The raising of livestock is a very important industry and an integral part of the agricultural system, with dairying (Fig. 114) as the dominant branch. Nearly three-fifths of the cattle are maintained for dairy purposes. Ninety per cent of the total farm income is now derived from livestock and livestock products, more than half of which is from dairy products. This indicates clearly the high stage of development attained in the feed crop-livestock-dairying type of land use. Much of this development has come in comparatively recent years. Recent data show that the county has 46 cheese factories, 2 creameries, and 7 receiving stations, and produces nearly 45,000,000 pounds of dairy products for market. These figures depict the evolution of a dairy section and appear large when standing alone. However, in its output of dairy products, Outagamie County is exceeded by a dozen or more other Wisconsin counties where the industry has reached a higher stage of development.

Though it is more than 280 years since the first mission was established in the Fox River Valley and more than a century and a half since the first crops were grown in Outagamie County, a substantial type of agricultural economy has developed. Opportunities in other parts of the state and nation that were more favorable to the gaining of a livelihood by agriculture have delayed the extensive occupation of these more northerly forested and cut-over lands. The stability of the type of agricultural economy practiced, the increased use of improved farm equipment, improved living conditions on the farm, and the growth of urban markets may be related to the small increase in rural population since about 1930. When will the whole upper Lake region reach a stage of agricultural development comparable to that of Outagamie County?

Urban Centers and Manufacturing. Measured by number of employees Outagamie County has become one of the 7 leading counties of the state. There are 12 urban centers, ranging in population from 475 to 34,000, but only 2 centers exceed 8000. These 12 centers contain more than two-thirds of the total population of the county. All the leading centers are along the Fox River where abundant water power and good transportation facilities are available. Appleton is the largest center and is a thoroughly modern and thriving industrial city. More than two-fifths of the population of the county is concentrated here, and Appleton gives employment to more than half the manufacturing employees of the county. Kaukauna ranks second, though it is only a quarter as large as Appleton. Factories for the production of dairy products are scattered throughout the county. While the forests were near at hand the valley was one of the principal lumber, pulp, and paper-making regions of the state; but, as the forest frontier retreated farther and farther, these industries declined relatively. However, paper manufacture and various allied industries still lead. Appleton now has several large paper mills and paper-converting plants. Its 72 manufacturing establishments give employment to more than 5000 people and turn out products having a net value of approximately $26,000,000.

The dairy industry now concentrates on three major products, viz., cheese, condensed milk, and powdered milk products. Its 46 cheese factories produce more than 15,300,000 pounds of American cheese (Cheddar and Colby). Other plants produce nearly 29,000,000 pounds of condensed and powdered milk products. Its butter production is small in comparison, although the annual output is about 750,000 pounds. Although most of the milk produced is processed in the county, nearly 15,000,000 pounds of milk and butterfat are shipped to other states.

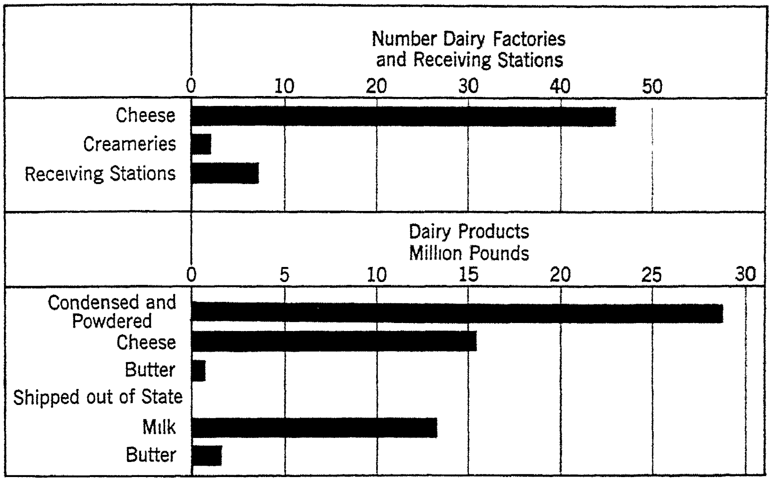


Fig. 114. Dairy establishments and products, Outagamie County, Wisconsin.

Summary. Because of its location on the Fox River route between Lake Michigan and the Mississippi River, Outagamie County was traversed by the white man very early in the history of the United States. Glaciation gave it a great variety of soils on a gently undulating surface, and many large marshland areas. Over all its upland the humid climate with long, cold winters and short, mild summers fostered a luxuriant forest growth. This combination of water route, surface, climate, and forest made it the natural home of many fur-bearing animals and the Mecca of fur trader, explorer, and missionary to the Indian. Later came the lumberman to harvest the native forest. Then followed the farmer, who found the varied soils and cool summer climate conducive to mixed farming and dairying. The water power of the county's principal streams and the advent of modern transportation facilities likewise fostered the development of manufacturing, especially the pulp and paper industries, which drew their raw material from the hinterland. Though agriculture and other industries are firmly established, the process of human utilization of nature's resources is still in progress as there are large areas yet undeveloped.

PROBLEMS

1. Resolved: That the Upper Lake Region offers greater opportunities as a home for man than do any two countries of northern Europe.
2. Can the Upper Lake Region maintain a population as large as either Norway or Sweden and on an equally high standard of living?
3. Will exhaustion of the high-grade iron ore of the Lake Superior region result in a transfer of the iron-mining industry to the East and South?
4. Is expansion of industrial development dependent upon maintenance of the relative importance of iron mining in the Upper Lake Region?
5. Describe the Upper Lake Region as it is likely to appear a hundred years from now.
6. Will agriculture and forest industries become the leading industries of the Upper Lake Region?
7. Should esentially all the Upper Lake Region be devoted to the production of a forest crop?
8. Can the Upper Lake Region develop a dairy industry comparable to that of southern Wisconsin?

CHAPTER II

The Physiographic Regions of the South

Southern Civilization and Its Physical Environment. There is no sharp line separating the South, or the Southern States, from the two sections to the north, although the Mason and Dixon line (the southern boundary of Pennsylvania), the Ohio River, and the southern boundaries of Missouri and Kansas form the Census Bureau's line of demarcation.

Politically, culturally, and historically the South is that portion of the United States in which slavery persisted longest. From this fact it is evident that the South overlaps the Census Bureau's line to include most of Missouri, which was a slave-holding state. The distribution of slavery as an economic institution was closely correlated with certain climatic conditions that favored the growing of certain staple crops in which culture slave labor could, the southern planter thought, be profitably employed. The northern boundary of the territory was not sharp, for climatic boundaries on plains are rarely definite in their localization. However, it is significant that this boundary is essentially a climatic one, separating a humid, warm, temperate climate in the south from a humid intermediate climate on the north (see Fig. 9).

The institution of slavery, the political doctrine of States' Rights, and the long and costly and destructive Civil War welded the people of the South into a political and cultural unit whose strength time has not weakened. The Solid South is something more than a political slogan. It is a reality. State boundaries there are within the South, but they are not so prominent in the sentiments of the people as in the North—the North as delimited by the Census Bureau.

We have stated in an earlier chapter that regional differentiation in economic activities in the American colonies began early. The northern colonists farmed some, fished much, manufactured more, and did a large part of the carrying trade of America. The southerners manufactured a little; they found on the land opportunities enough to absorb most of their energy. Agriculture has remained the dominant economic activity with the South ever since; although there has been rapid increase in manufacturing since about 1930, agriculture will long continue to occupy the attention of the majority of the people.

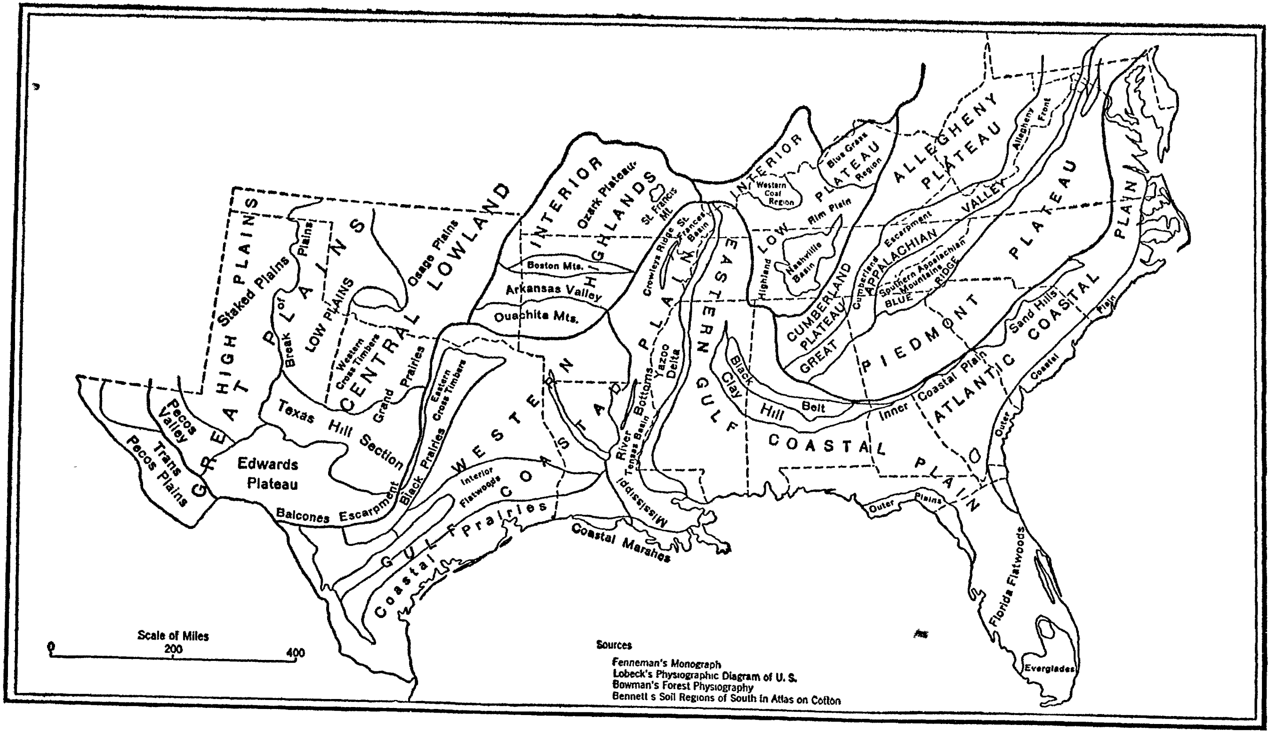


Fig. 115. The physiographic regions of the south.

Southern civilization, therefore, is preponderately an agrarian civilization. There is no such quantity and concentration of wealth as one finds in the industrial East. Rural communities are often poorer than urban ones. The taxable wealth of the entire South is much less than that of the three Middle Atlantic States. There is, therefore, less public money for schools, colleges, libraries, museums, and public improvements.

The tempo of life is the tempo of an agrarian community. It lacks the snap and vigor of industrial regions. There is more conservatism, for conservatism finds an optimum environment in slowly changing economic regions. A new day, a new economic order, a new vision of the relation of man to nature, however, is spreading over the South. Although only a beginning has been made, the new order is on a firm foundation. The old order utilized but little more than one resource—the soil. The new is making strides toward the exploitation of all the varied and abundant resources known to science. Manufacturing is slowly and surely advancing to demand a larger share of the attention of the enterprising southerners. The South is tending, therefore, toward a more balanced economic order.

We begin our study of the geography of the Southern States by a brief consideration of the physiographic features, i.e., of the lay of the land, the bedrock, the distribution of the minerals as the physical background of southern civilization and development.

The physiographic regions of the Southern States east of the Mississippi River are for the most part extensions of those of the Northeastern States, previously described. Although the surface, soils, and minerals are similar in the two sections, the southern regions differ enough from those to the north to demand further consideration (Fig. 115).

The Coastal Plain. The Coastal Plain, which has a slight development, as we have seen, in New England, New York, and New Jersey, is almost entirely a Southern physiographic province, for it borders the South Atlantic and Gulf Coasts from Delaware Bay to Veracruz, Mexico, and is much wider in the South than in the Northeastern States or in Mexico. In North Carolina it is 200 miles wide, and in eastern Texas more than 300. In the United States its total area is about 365,000 square miles, with about 255,000 square miles in the South.

The Coastal Plain and the Continental Shelf are the outer edges of the North American continental plateau, the Continental Shelf being the submerged portion of this plateau. The eastern shore line of the continent has not always held its present position. At the beginning of the formation of the Coastal Plain, several millions of years ago, the shore line was somewhere near the present inner border of the plain, and during these millions of years it has been gradually receding. The older deposits of the

Coastal Plain are, therefore, at the inner border, and at the outer, the advance of the land on the sea is still in progress. The rock of the Coastal Plain consists of marine deposits, the material being derived from the old land to the west and northwest. Since the Coastal Plain is young geologically, the rock material is largely unconsolidated.

From Chesapeake Bay to the Rio Grande, with the exception of southern Florida, the coastal features are much the same—sandy barrier beaches thrown up by the waves, smoothed in outline on the outer margin by alongshore currents, and separated from the mainland, except here and there, by tidal lagoons or salt-water marshes.

The barrier beaches that form a cordon along the shore are broken by numerous tidal inlets or by broad estuaries. Chesapeake Bay, Albemarle, and Pamlico Sounds, Mobile Bay, and Galveston Bay are the larger submerged bays and estuaries. Submergence has been greatest in the northern part of the Coastal Plain. In the Chesapeake Bay region it has been so great that tidal waters extend across the Coastal Plain, and Baltimore, Washington, and Richmond, like Philadelphia and New York, although on the inner edge of the Coastal Plain, are reached by ocean vessels.

The rivers of the Coastal Plain in their lower course are aggrading streams, building alluvial flood plains and attempting to fill the estuaries by bars or deltas. This tendency toward the filling of the bays and estuaries, which are naturally shallow, as is characteristic of sandy coast lands, puts a great financial burden on our National Government in keeping these channels open for navigation in order that ocean vessels may reach the ports on the borders and upper reaches of the estuaries. This work has given deep, navigable channels for ocean vessels to Baltimore, Norfolk, Wilmington, Charleston, Savannah, Brunswick, Jacksonville, Tampa, Pensacola, Mobile, New Orleans, Galveston, and Houston.

Interesting coastal features of the Atlantic Coastal Plain are the scallops, cusps, and offshore shoals that occur on the coast of the Carolinas and affect coastwise navigation. These are attributed to the action of eddies that have a counterclockwise movement and lie between the shore and the Gulf Stream. The material of the cusps and shoals comes from the outer edge of the Coastal Plain, from the shallow parts of the ocean bottom, or from stream deposits. That of the Cape Fear cusp and Frying Pan Shoal is derived largely from silt and sand brought down by the Cape Fear River. The more prominent of the shoals are those that lie offshore from Cape Fear, Cape Lookout, and Cape Hatteras, Cape Hatteras being so dangerous to navigation that it is sometimes called the "graveyard" of the Atlantic Coast.

Although submergence along the outer edge of the Coastal Plain has been of some advantage to water transportation, river, coastwise, and overseas, the estuaries hinder land traffic. Roads and railroads, paralleling the coast, generally lie inland beyond the heads of the estuaries. To reach the cities at the outer edge of the Coastal Plain, the more important roads and railroads are forced to follow the longer axes of the peninsulas that lie between the estuaries.

The Inner Border. At only a few places on the inner border of the Atlantic Coastal Plain is the contact with the old land to the west a sharp one, either in surface expression or in mantle rock. In some places there are prominent sand hills; but, farther north, sands and gravels that show wave and river action, characteristic of the Coastal Plain, mantle the eastern edge of the crystalline rock region. In this zone of contact, most of the Atlantic Coast rivers have formed a series of rapids, in the larger rivers these are 15–25 miles long, as they flow over the crystalline rock at the edge of the old land into the valleys and channels which they have carved in the Coastal Plain. Not only is this zone evident in the rivers of the Atlantic Coastal Plain from the James River in Virginia to the Altamaha in Georgia, but it is also marked on the border of the Gulf Coastal Plain by the rapids in the Tennessee River near Muscle Shoals and in the hard rock in the Arkansas Valley near Little Rock, Arkansas. The line connecting the series of rapids has long been known as the Fall Line. At Baltimore the outer edge of the Fall Line zone is at sea level; at Augusta, Georgia, it is 98 feet above tide; at Macon, 280 feet; and near Muscle Shoals even higher.

The Peninsula of Florida. The peninsula of Florida is a portion of the coastal platform or plateau that has been warped upward sufficiently to bring a large area of land above sea level. A small portion of Florida stands 300 feet above tide, but the larger part of the area of the state is less than 100 feet above sea level, and all the southern third lies between 0 and 50 feet. Limestone is the basal rock of most of Florida and is the surface rock of a large part of the interior (Fig. 116).

The Belts of the Coastal Plain. The rock materials of the Coastal Plain are arranged roughly into longitudinal belts that are more or less parallel to the borders of the plain. It is this belted arrangement that has given origin to the term "Belted Coastal Plain." Detailed study and mapping have revealed numerous belts many of which are continuous across one or more states, but in our study we shall recognize but two: an outer, low, flat belt known as the Flatwoods and Coastal Prairies; and an inner and higher belt, called the Inner Coastal Plain.

The Flatwoods, extending southward from Delaware Bay in a more or less continuous belt, with only a few interruptions, to the alluvial valley of the Mississippi, is about 20–40 miles wide. Its surface is almost a dead level with only a few sandy hillocks or broad, swamp-covered shallow valleys to break the monotony. Some areas are so flat as to be covered with water much of the year. Locally, such swamps are known as "bays," "pocosins," and, in some sections, "swamps." They support a hydrophytic type of vegetation. These marshy patches on the uplands are distinctly different in origin from the marshes bordering the sluggish streams that meander through the Flatwoods belt. The marsh patches on uplands are merely inheritances from the elevated Continental Shelf; the marshes along the lower courses of streams are the result of submergence of shallow valleys carved in the outer edge of the Coastal Plain when it stood at a higher level in very recent times.

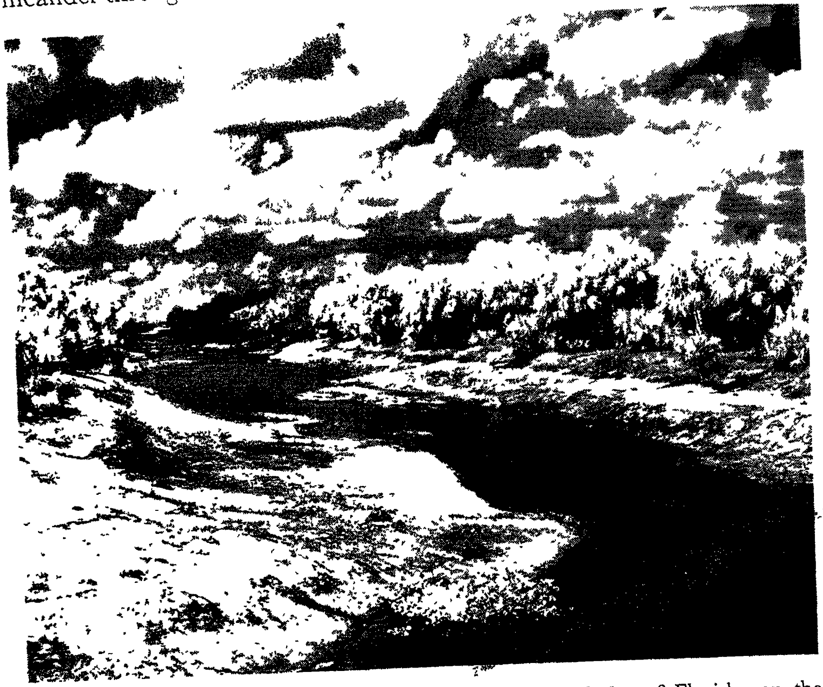


Fig. 116. A palm-bordered drainage channel in the Everglades of Florida, on the Seminole Indian Reservation. *Courtesy, Florida News Bureau.*

The Flatwoods belt is interrupted in southern Georgia and southeastern Alabama by the Florida anticlinorium, but from Mobile Bay westward it is well defined. In the west Gulf region, this low, flat area, inland from the coastal lagoons and barrier beaches, is known as the Coastal Prairies, and in some parts of Louisiana and Texas is 50 or even 100 miles wide.

The inner belt of the Coastal Plain is much wider than the Flatwoods and Coastal Prairie belt, and is higher and rougher. North of North Carolina, most of the western belt lies less than 200–300 feet above the sea, with only the westernmost edge reaching 400 feet; but farther south it is higher. In Alabama, Tennessee, Arkansas, and Texas, the inner border in general reaches 500–600 feet, and a few areas are 1000 feet above sea level. The higher altitudes of this inner belt and the looseness and unconsolidated condition of the material have given the rivers free scope in their work of dissection. The gradient of the Coastal Plain streams is less than the oceanward slope of the land; hence the valleys are deepest near the inner border of the Inner Coastal Plain. From central North Carolina to western Alabama, and even westward, there is a strip, 5 to 25 miles wide, of thoroughly dissected land known as the Sand Hill section, so hilly and sandy as to be of little use except for the growing of forests and orchards.

In the early period of the formation of the Gulf Coastal Plain, a great bay extended as far north as the site of the present mouth of the Ohio. Western Kentucky and Tennessee, even portions of Missouri and eastern Arkansas, therefore, form a part of the Coastal Plain, although 300–500 miles from the Gulf.

The only exception to the belted arrangement of the Coastal Plains is the alluvial valley of the Mississippi River which cuts across the belts and divides the Gulf Coastal Plain into two parts, the East Gulf Coastal Plain and the West Gulf Coastal Plain. These are discussed as the Mississippi Valley Plains.

The Black Belts. In western Georgia, across Alabama, and in Mississippi, the hill region stands prominently above an inner lowland of calcareous materials, known as the Black Belt because of its dark soil, which is admirably suited to the growing of cotton. Because of its early adaptability to cotton growing, it has a dense Negro population. Texas also has a Black Belt, known as the Black Prairies, which is separated from another area of calcareous soil to the west, also with dark soil, called the Grand Prairies, by an outcropping belt of limestone called the Cross Timbers.

Minerals of the Coastal Plains. Since the rock materials of the Coastal Plain are marine in origin and, probably, in no section have been disturbed by igneous intrusions or extrusions, the minerals must be such as are deposited in marine water accumulated in marine marshes and lagoons, or formed by chemical action subsequent to deposition. The more important minerals are salt, gypsum, sulfur, oil, gas, lignite, coal, marl, clay, and limestone.

The Mississippi Valley Plains. The alluvial valley of the Mississippi is an aggraded plain 20–75 miles wide and 600 miles long. It is bordered on the east by an almost continuous line of bluffs interrupted by only a few small streams. Its western border, although there are here and there low bluffs, is broken by several broad alluvial plains like those of the Arkansas, Red, Ouachita, and other rivers. The profile of the Mississippi River is concave, and the slope very gentle—4.8 inches per mile from Cairo to Vicksburg, 2.9 inches from Vicksburg to the mouth of the Red River, and about 2 inches from the Red to the head of the passes. As a result of these conditions, the stream is continually aggrading, and in flood stage its surface stands several feet above the level of the alluvial plain on either side. There are about 30,000 square miles of rich alluvial land between Cairo and the Gulf, and the larger part of this is subject to overflow during the flood period unless protected by levees.

The Piedmont. The Piedmont Plateau lies just to the west and northwest of the Coastal Plain. Its length is about 900 miles and its width is from 20 miles in Maryland and 50 miles in central Virginia, to 150 or more in North Carolina. Farther south, it decreases in width. Its entire area is about 74,000 square miles. As one views its surface from the top of a high building in any of the Piedmont cities, one sees an almost perfectly dead-level plain with here and there a few low, rounded hills rising above the general level. These elevations are monadnocks, residuals, due to superior hardness and to location on the divide between river systems. Being in a region of heavy rains, the surface of the Piedmont is creased by many rivers and valleys, shallow and broad as a rule in the central portion of the Piedmont, but narrower on the eastern border. The larger streams pursue a course over the gently sloping surface toward the sea, irrespective, in general, of the hardness of rock; but some of the tributaries show rock adjustment. The channels of the larger streams, therefore, have numerous rapids and pools. Since the inner border of the Piedmont stands 700–1500 feet above the sea, and the outer from sea level to about 800 feet, the Piedmont streams have much water power. The slopes of the land are, as a rule, except near the inner border, gentle, and the relief is slight. Railroads, therefore, find easy grades; topography has little influence on the road; and cultivation is little interfered with by rough lands. A large proportion of the land is tillable.

The rocks of the Piedmont are largely crystallines, so deeply weathered that in places the residual disintegrated rock is 50 or more feet thick. Igneous intrusions and extrusions are common. Most of the monadnocks, like Stone Mountain, near Atlanta, are intrusions. It is largely the intruded rock that is worked in the granite quarries of North Carolina and Georgia.

The inner edge of the Piedmont is marked by numerous outliers of the Blue Ridge. The Piedmont Plateau and the Blue Ridge belt of mountains form in the South what is commonly known as Older Appalachians, an expansion of the physiographic province of that name in the Northeastern States (Fig. 117).

The Blue Ridge Province. The Blue Ridge from North Carolina northward is a fairly distinct ridge of resistant rock flanked by numerous hills of sandstone and other hard rocks, which separate deep coves or valleys. In North Carolina and southward, the Blue Ridge is the eastern escarpment, some slopes of which rise 2000 feet in 3 or 4 miles, of the mountain area, the Southern Appalachian Mountains. This mountainous area, 75 or more miles wide in North Carolina, consists of several short, rather distinct, chains that lack uniformity in trend. There are numerous cross ranges, but some of the more prominent ranges, like the Unakas and Great Smoky, have a trend parallel to the general trend of the Blue Ridge belt. The crests of most of these mountains fall into a rather uniform plain when seen from a height of 2000–2600 feet, and are thought to be remnants of a former extensive plateau now so deeply dissected and destroyed by erosion that valley bottoms and mountain slopes take up most of the area. The peaks are rounded, and the slopes covered with a deep layer of mantle rock and humus, except where the removal of the forest has given the erosive forces full play. The most prominent of the mountain peaks is Mount Mitchell, 6684 feet above the sea, the highest mountain east of the Rockies. Other prominent peaks are Mount Guyot, Clingman's Dome, Mount Le Conte, Grandfather Mountain, Mount Pisgah, and Black Mountain.

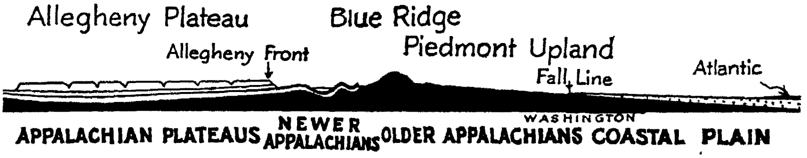


Fig. 117. A generalized cross section from the Atlantic westward across the Appalachian Highlands at about the latitude of Washington, D. C. It shows the positions of the Older and Newer Appalachians, and the relation of Coastal Plain to Piedmont, Blue Ridge, Great Valley, and Allegheny Plateau. *After A. K. Lobeck.*

The rocks of the Southern Appalachian Mountains are largely metamorphosed igneous, but on the western border there are quartzites and slates. The summit of the Unakas on the western border is capped with resistant quartzites. The mountains yield a great variety of economic minerals, largely igneous in origin, such as rare earths, mica, feldspar, and metallic minerals, but nowhere in quantities great enough to attract much capital. This can hardly be classed as an important mineral region.

The Blue Ridge in Virginia is cut by three prominent streams, the Potomac, the James, and the Roanoke; and in addition to these there are a large number of wind gaps. All these gaps permit considerable freedom of movement of goods and people; but the Southern Appalachian Mountains are a distinct barrier to transportation and communication except along a few valleys. Asheville, in the Asheville basin, carved in less resistant rock by the French Broad and two of its tributaries that here join the main stream, is a railroad center and the center of radiating highways. Agriculture is possible only in the valley bottoms and on the lower and less steep slopes of the Southern Appalachian Mountains. Most of the slopes of the mountains are too steep for permanent cultivation and should be kept covered with forests.

The Great Valley. The Great Appalachian Valley in the Southern and Northeastern States is similar in origin and general characteristics. In the South the larger divisions of the Great Valley are the Cumberland Valley in Maryland, the Shenandoah in Virginia, the Valley of East Tennessee, and the Coosa in Alabama. From the Potomac southwestward to southwestern Virginia, the Great Valley narrows to 8–15 miles in places; but in Tennessee it is from 40 to 60 miles wide. The highest part of the Great Valley in the south is in southwestern Virginia. From this higher land in southwestern Virginia and the nearby portion of North Carolina, several streams take their rise: the James, Roanoke, New, Sandy, Clinch, and Holston. From Staunton, Virginia, northward, the valley slopes toward the Potomac and is drained by the Shenandoah. The Tennessee River and its tributaries drain southwest Virginia and east Tennessee, and the Coosa and its tributaries carry off much of the water of the Great Valley in Georgia and Alabama. From southwest Virginia to central Alabama, the valley slopes from about 2700 feet above sea level to above 500 feet.

There are no canoe-shaped valleys in the Southern States in the Great Valley, but evidences of intensive folding and faulting are common, and one finds the same repetition of rock-cored ridges as in the North. Many of the limestone beds have been metamorphosed into marble, which is being quarried in Tennessee and Georgia. Some of the marble outcrop ridges may be traced for scores of miles, but it is only here and there, where transportation facilities are adequate, that the marble is quarried. Most of the ridges of the Great Valley are of resistant sandstone or quartzite or of cherty dolomitic limestone. Some of the chert ridges stand up 100 feet or more above the nearby valley floor and, being too steep and sterile for profitable cultivation, are used as pasture lands or left in forest.

surface features being covered with deposits of the Coastal Plain and the alluvial valley of the Mississippi.

Western Texas and the most of Oklahoma lie in two physiographic provinces: the Prairies, a phase of the Interior Lowland province; and the Great Plains, which are divided into the Low Plains and the High Plains. These two provinces have their greatest development in the North Central States. The Prairie province is represented in Texas by the Black and Grand Prairies, separated by a cuesta of resistant sandstone known as the Cross Timbers, as previously described.

The western part of Texas in the Great Plains belt is classed in this book as a part of the West, and is discussed with the Western States.

QUESTIONS, EXERCISES, AND PROBLEMS

1. In a journey from Louisville, Kentucky, eastward to Norfolk, what physiographic regions would one cross? Describe each region.
2. What regions would one cross in traveling from Louisville to Florida by way of Nashville and Chattanooga, Tennessee?
3. What are the effects of the drowning of the coasts of the South on agriculture, navigation, and commerce?
4. Why has the National Government not reclaimed the swampy lands of the South as it has the arid lands of the West?
5. Make a careful study of the most disastrous floods that have occurred in the Mississippi Valley. What physical conditions make for floods? Is flood-protection work a duty of the National Government or of the individual states? What engineering projects may be worked out to reduce the disastrous effects of the floods on the Mississippi?
6. What geographic conditions make western North Carolina a "playground" for both North and South? What contributions has man made to this phase of land utilization?
7. Look up "Tennessee Valley Project" and "Tennessee Valley Authority." From the standpoint of size of area drained, rainfall of the region, gradient of the river, and its location, show the suitability of this valley for such a project.

CHAPTER 12

Agriculture in the South

Perhaps in no other section of the United States has there been such a phenomenal change in agriculture (since 1910) as in the South. The effects of the Tennessee Valley development, the cotton boll weevil, industrial development, the application of machines to agriculture, and other factors have brought about shifts in cotton farming away from the Piedmont and the old South to the river flood plains of the Mississippi, to Texas, and to the less humid lands of Oklahoma. Rapid progress is being made in diversification of crops. Livestock has become increasingly important, tenancy is decreasing, rural electrification is advancing rapidly, and more attention is being given to soil erosion and tree crops, as well as to forestry. An attempt is made in the following paragraphs to analyze agriculture in the South from the standpoint of all environmental conditions involved.

THE DEVELOPMENT OF AGRICULTURE IN THE SOUTH

Agriculture in the Virginia Colony. Agriculture in English America had its beginning in Virginia. Here was done much of the early colonial experimenting in southern agriculture. The contrasts in summer temperature between old England and the lower Chesapeake country led the people who directed the economic policies of the mother colony to believe that many subtropical products could be grown here. Subtropical and tropical products were much preferred, for in the growing of these the Virginia farmers would not compete with the farmers of the mother country. The fig, the orange, and the French grape were all tried out in the Jamestown settlement. The presence of the wild mulberry led the colonists to try the raising of silkworms. The cultivation of these was soon abandoned because of the great amount of careful and skilled labor involved, and farming activities were fixed upon two of the several cultivated plants the Indians had long been raising as staples—corn and tobacco. It is recorded that, under the direction of Captain John Smith, a crop of corn was raised in 1609, probably the first corn raised in English

America by Englishmen. Wheat, oats, and barley were sown later, with some success; but tobacco, the first crop of which was raised in 1612, soon became the leading money crop. It is reported that the people of Virginia were wont to say "God in the creation did first make a woman, then a man, thirdly great maize or Indian corn, and fourthly tobacco." Cattle were introduced as early as 1609, and, by 1611, 160 had been brought across the Atlantic. By 1631 there were about 5000, of English and Irish breeds chiefly, although some had been brought from the Spanish West Indies. Horses were the first livestock to reach Virginia. Goats and hogs multiplied with great rapidity, but it was not until the close of the seventeenth century that sheep were at all numerous, for they easily fell a prey to wild animals in a newly settled country.

Agricultural practices were chiefly those of old England, with some slight modification due to Indian influence. For tobacco and corn, hand labor was used. Little could be done in the growing of cereals until plows became common. In 1618 there was only one wooden plow in the colony; and 30 years later, when the population numbered 15,000 whites and 300 slaves, the majority of whom were tillers of the soil, only 150 plows were in existence in Virginia.

The settlement on the James River was the nucleus for agricultural expansion northward, southward, and westward; but always, for more than half a century, the new settlements were planted on or near tidewater, that contact might be maintained with the mother country.

The rapid depletion of the soil by tobacco culture, the resultant migratory agriculture (a field was rarely cultivated more than 3 to 6 or 7 years before being abandoned), and the increasing number of colonists, particularly near the middle of the seventeenth century during the civil wars in England, brought about an active expansion of the agricultural area. By 1620 the Jamestown settlement had expanded up the James River 70 miles, and extended back from the river on either side a distance of 20 miles or more. About 40 years later, there were almost continuous settlements from Maryland to the Albemarle country.

Expansion of the Agricultural Area. By 1700 a few farmers had gone far inland on the Piedmont, but most of the settlements were to the east of the Fall Line. The Great Appalachian Valley was entered by farmers by 1750, and in this great thoroughfare Virginians mingled with land seekers from Pennsylvania, Maryland, and New York. Thirty years later, hundreds of hardy farmers, following daring hunters and traders, were crossing the Appalachian Highlands and staking out farms in the Monongahela and Ohio Valleys, the fertile Bluegrass region of Kentucky, and the Nashville basin; and by 1790 there were in southwest Pennsylvania and nearby portions of Ohio and West Virginia and Kentucky nearly

74,000, and in Tennessee nearly 36,000 pioneers. From these centers people spread out into other parts of these and nearby states, being guided in their movements largely by the rivers, and planting their new settlements for the most part on the more fertile lands, for always the great majority of migrants were farmers. Kentucky and Tennessee contributed large quotas to the early settlers in Indiana, Illinois, Missouri, Arkansas, Alabama, Louisiana, and Texas.

In all this back country, the crops and agricultural practices were somewhat changed from those early used in Virginia; general farming was the rule, for each community was by necessity largely self-supporting and the crops raised were supply crops.

Agriculture in the Carolinas. The settlements in northeastern North Carolina were an expansion of those of southern Virginia. About 100 farmers had settled at Chowan on the shores of the broad Albemarle Sound by 1653. Nine years later, large accessions, mostly to Quakers, were made to the Chowan settlement. By 1665 there were 300-400 families on the borders of the sound. In time the Albemarle settlements expanded westward over the Piedmont, and 100 years or more later the Carolinas sent land-hungry pioneers into the eastern Tennessee and trans-Allegheny regions.

In 1664 a few English colonists from Barbados cleared the bottom lands along the Cape Fear River, well back from the coast, and began the cultivation of cotton. The Charleston settlement dates from 1670. Cotton was from the first much cultivated. Settlements in this area grew rapidly, and it is claimed that by 1732 there was not a thousand-acre tract within 100 miles of Charleston or within 20 miles of a navigable stream that was not claimed as farm land by English, New England, Scotch-Irish,Dutch, French Hugenot, Acadian, or English Quaker colonists. The introduction of rice culture, and, a half-century later, of indigo, added greatly to the wealth of the communities.

The Georgia Colony. In the Georgia colony, the first settlement was at Savannah in 1733. Rice, indigo, and upland cotton received attention; but sea-island cotton from the first proved a profitable money crop, and its cultivation spread rapidly on the coast islands.

Rice, indigo, and sea-island cotton were coast products; hence they played little or no part in the expansion of agriculture in the Lower South. As long as the colonists of the Lower South hugged the coast line, these products dominated in agriculture; but upland cotton, with which the upland farmers had long been experimenting, brought about the great westward movement in agriculture in the Lower South.

Early Practices in Agriculture. In an era of agricultural expansion, with large areas of virgin soil that were purchased in large blocks at only a

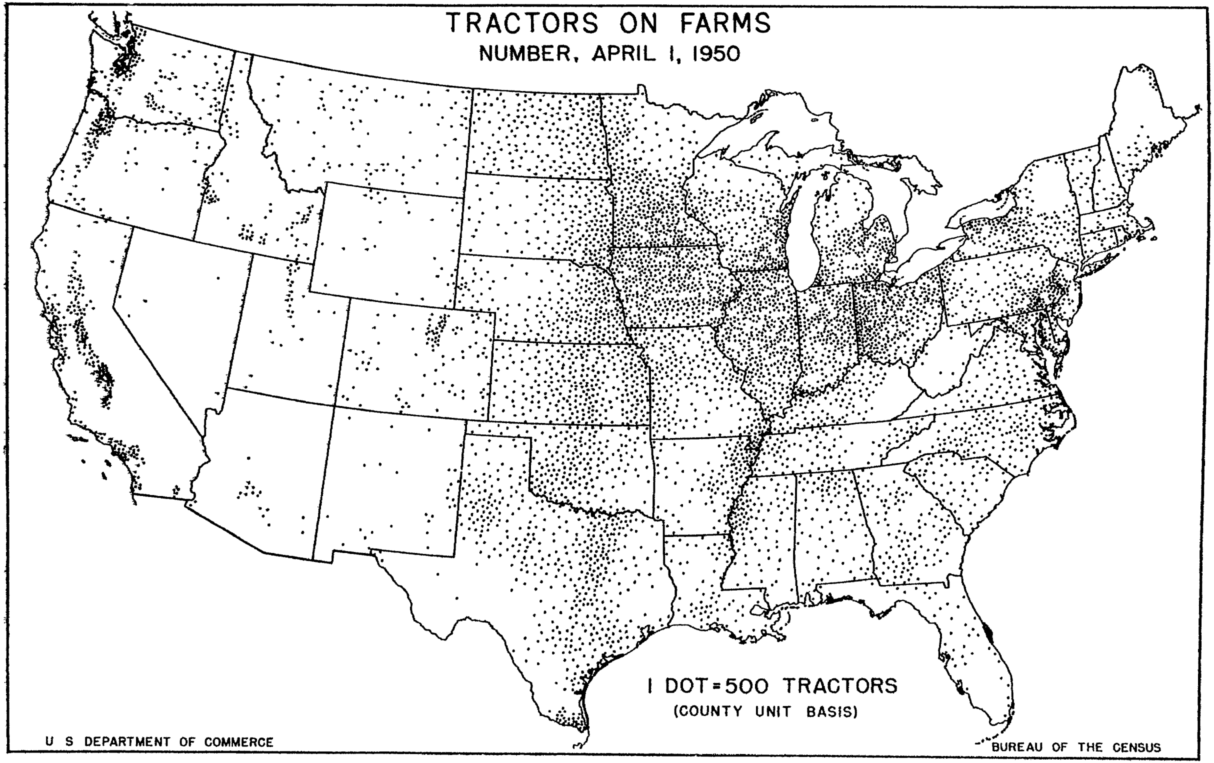


Fig. 118. The distribution of tractors used on farms in the United States.

nominal sum, little attention was paid to improvement in agricultural practices. Extensive agriculture, rather than intensive, was the rule, for, as long as new lands could be had, greater profits could be obtained by soil robbing than by careful tillage. Economical tobacco raising by slave labor was thought to demand 50 acres of arable land to a Negro, and as an overseer was dear unless he had 20 Negroes under him; 1000 acres of arable land, it was thought, was necessary for the profitable use of capital. The same condition held true for cotton.

Here and there attempts were made at improvement in methods of cultivation, in livestock, and in machinery. Virginia and Maryland, grown poor by the exhaustive cultivation of tobacco, were among the leaders in agricultural improvement. A state agricultural society was founded in Virginia in 1790. Baltimore had a *Farmer's Weekly* in 1835, and a chair in agriculture was established at the University of Georgia in 1834. Yet it is claimed that until 1856 a plow was almost unknown in many counties in South Carolina.

Modernizing Agriculture. Machinery, until about 1910, has never been much used in the southern states. There has long been a prevalent notion among southern farmers that the Negro, whose chief implement for a century or more in America was the grub hoe, could not handle machinery. This idea, however, is fast being changed. The South has begun to multiply its manpower by the use of power machinery. It should be remembered, however, that for many of the southern crops the invention of satisfactory machinery was slow in coming. A cotton-picking machine, of which there are several types, has only come since about 1930. It is expensive and applicable only on the large level areas found in Mississippi and Texas. Tobacco still requires much hand labor, particularly in harvesting and curing. The longer tillage and growing season partly compensates for the inadequacy and the scarcity of farm machinery. A farmer has many more days in the Southern States to fit his ground for planting or sowing, and a longer harvest season, than the farmer of the Northern States, and thus has less need for machinery (Fig. 118).

Today no section of the country is changing its age-long agricultural practices and traditions so rapidly as the South, chiefly because there is a great chance for improvement. The boll weevil, although destroying hundreds of thousands of bales of cotton each year, is, after all, proving a blessing. The one-crop system is doomed. Farmers are learning that more money is to be made from semi-luxuries, like citrus fruits, peaches, apples, early vegetables and small fruits, dairy products, and beef cattle, than from the staple foods and fibers. There is a limit, of course, to which these intensive types of land utilization may be carried, but that limit is not yet reached.

FACTORS AFFECTING AGRICULTURAL PRODUCTIVITY

Agriculture is predominantly the occupation of the people of the Southern States. Although the South has but 30 per cent of the total population of the country, it has 46 per cent of the rural population, and only 20 per cent of the urban. Although agriculture dominates the activities of the people, the South is not today so great an agricultural region, from the standpoint of production, as the Northern (Northeastern and North Central) States. The total land area of the two sections differs but little: the North has 30.9 per cent of the land area of the United States, and the South 29.8 per cent; yet the South had only about 95 per cent as many acres of farm land as the North in 1950; and the area of cropland was only 53 per cent of that of the North; the value of farm property (land and buildings) 60 per cent; and the gross income from all agricultural products, about 55 per cent.

This lower ranking is not wholly, if at all, the result of natural geographic conditions adverse to the farmer. It is probable, as later discussion tries to show, that the physical environment of the Southern States is quite as favorable for agriculture as that of the North.

The Population Factor. The rural population in each section numbers about the same, but the North has nearly twice the total population. Although the two sections are similar in age of settlement, the North is older in its economic development. There are, therefore, fewer acres per person of total population in the North than in the South. The value of the agricultural land is greater, more extensive improvements have been made, the land is tilled better, and consequently the returns are greater. Agriculture has reached a more advanced stage of development, and man is utilizing nature's resources to a fuller extent than he does in the South.

In the South are large areas of forests yet to be cleared, much cut-over land not included in farms adapted to special types of farming, and many millions of acres of wet land capable of intensive cultivation when once drained. In fact, the South Atlantic and Gulf Coastal Plain, extending a considerable distance southwestward on the Texas coast, contains the major portion of the wet reclaimable lands of the United States. These lands will be used more and more as population increases.

Tenancy and Size of Farm. Tenancy is more prevalent in the South in general than in the other major sections of our country. The percentage of farms operated by tenants and croppers in the North ranges from 40 for Illinois, 42 for Iowa, 36 for Kansas, down to 8 for New York, 4 for Vermont, 3 for Massachusetts, and 3 for Maine. In the west 8 per cent of the farms of Nevada are so operated, 17 per cent in Montana, 12 per cent in California, and 12 per cent in Washington. In the South the figures are 15 per cent for West Virginia, 28 for Virginia, 64 for North Carolina, 50 for Tennessee, 80 for South Carolina, 80 for Georgia, 96 for Mississippi, 40 for Texas and 63 for Arkansas. The Wheat Belt, Corn Belt, and Cotton Belt have the largest percentage of tenants. The evil effects of tenancy need no comment. In the North and West the tenant farmer is normally working toward buying a farm, and his tenancy thus represents merely a stage on the way to ownership. In the South, on the other hand, there are large numbers of tenants who do not look forward to ownership and for whom tenancy is the normal economic situation.

Since the Civil War there has been much splitting up of large plantations, yet not enough for the best agricultural interests of the South. The census figures are very misleading as to the size of land holdings. They show that in 1950 over 50 per cent of the farms of the South had less than 50 acres; 72 per cent had less than 100; and only 10 per cent of the total number had more than 1000 acres; and that in the South Atlantic States the average size of the farms had decreased from 376.3 acres in 1850 to 157.4 acres in 1880, and 100 in 1950. In two other divisions of the South there had been similar decreases. But a farm in the census reports "is all the land which is directly farmed by one person managing and conducting agricultural operations either by his own labor alone or with the assistance of members of his household or hired employees . . . . When a land owner has one or more tenants, renters, croppers, or managers, the land operated by each is considered a farm." A large percentage of the plantations of the South are divided into plots and rented out to tenants, mostly Negroes, each "one-horse" or "two-horse" farm being considered a farm by the census, although the owner, in many if not most cases, exercises almost complete control over the tillage. Tenants of this sort are at best only poor agriculturists, and undoubtedly the plantation as a whole would yield much more than the present output if it were divided and tilled by owners.

At present, there are indications that tenancy—long a symbol of Southern poverty—has passed its peak. The Southern Regional Council in Atlanta, Georgia, notes a decided rise in farm ownership and a drop in farm tenancy, along with better pay for farm workers still on the land. New industries are locating in the South more rapidly than in any other large section of the country. This means jobs for many who were formerly "share-croppers," and that type of farmer is fast disappearing from many sections. Also, many persons from the farms have migrated to industrial jobs in both North and South since 1940. The use of agricultural machinery is rapidly increasing, and the livestock industry is increasing, all of which requires less manpower.

The Long Distance to Market. The long haul to the greater markets of the country is a factor that has retarded agriculutral development. Of the crops that are raised in both North and South, only the early crops of the South can compete successfully in the northern markets. The development of industries in the South and an increase in the consuming population accompanying each development will prove a great advantage to the farmers. The larger population will increase land values, increase taxes, and force the farmers to get more out of their land.

The Soil Factor. The South has a great variety of soils, owing to the wide variety of rocks from which the parent material was derived (see Chapter 2 for full discussion of soils; this should be reviewed by the student) and the varied climatic topographic conditions under which the mature soils have evolved. The South, east of the 100th meridian or the 25-inch isohyet, has humid-region soils, the pedalfers. In order from north to south are the Gray-Brown Podzolic, and the Red and Yellow Podzolic Soils. The Yellow Soils are wide-spread over the Coastal Plain from eastern Virginia to central Texas. North and west of these are the Red Soils. They dominate in the inner, hilly portion of the Coastal Plain, on the Piedmont, in the Great Valley south of the Virginia-Tennessee boundary, in northern Alabama and Mississippi, and in most of Arkansas. Figure 12 shows the states and parts of states in which the Gray-Brown Soils are found, and these are far superior in productive power to the Red or the Yellow groups to the south. The dark soils of the Black Belts of Alabama and Texas are known as Prairie Soils.

Soils of the Coastal Plains. Quartz forms a large part of the soil material of the Coastal Plain. Chapter 2 discusses the origin of the parent soil material. In its journey to the sea the weathered rock was subjected to solution and abrasion, and after deposition in the ocean there was further solution and comminution by waves and currents. The material from which the present-day topsoils have been derived was therefore poor in soluble mineral matter. In texture both the parent material and the mature soil are largely gravel, sand, silt, and a little clay. Leaching, due to the heavy rainfall and the high porosity of the soil, has been active during the evolution of the parent material into what the farmer is tilling today. Coastal Plain soils need heavy application of fertilizers for profitable crops. In the Black Earth Belts in Alabama and Texas Prairie Soils predominate.

Soils of the Piedmont. In the Piedmont province the parent materials from which the Red Soils are derived are residual, old, and therefore well decomposed chemically. They are deep, except on slopes. Sandy loam, clay loams, and clay predominate and are reddish in color owing to the oxidation of the iron oxides. The subsoil is much more compact than the surface soil. In many parts of the Piedmont the lighter soil on an impervious base offers the best of conditions for soil wash and gullying. The control of the soil erosion is a problem on most farms, particularly in the southern portion where the winter is not cold enough to freeze the ground. In the northern sections of the Piedmont the snow and ice cover checks winter erosion; and the freezing of the soil water produces an open structure in the soil which favors sink-in during the summer.

The heavier soil of the Piedmont provinces requires heavier agricultural implements than are used in the Coastal Plain. As the soil is fairly uniform in quality and lithological compositon, the varety is not great. Differences in temperature, due to a wide range in latitude and altitude, are an important factor in crop distribution. Cotton grows southeastward of a line from Petersburg, Virginia, to the southern end of the mountains in northern Georgia. Corn and other cereals, legumes, tobacco, and fodder may be produced over the entire area. Tobacco, however, is confined chiefly to southern Virginia and northern and eastern North Carolina. It is also grown on the Coastal Plain in both South Carolina and Georgia.

Soils of the Southern Appalachian Mountains. Though most of the parent soil material of this physiographic region has been derived from igneous and metamorphic rocks, like the rocks of the Piedmont, the mature soils are classed in the Gray-Brown Podzol group. The temperatures in the mountains are lower than on the Piedmont, the rainfall is heavier, and deciduous trees dominate in the forests.. The mature soils, therefore, have evolved in an environment quite unlike that of the Piedmont. Except along the major valleys that are traversed by railroads and hard-surface roads, farming is confined chiefly to the production of home supply crops. Mountains in most parts of the world are the natural habitat for the livestock industry. A beginning has been made in the Southern Appalachians in the production of butter and cheese, scattered patches of mountain pasturage being utilized; but the mountain slopes are too densely wooded in their natural state to permit the growth of an abundance of fodder, nor do they rise sufficiently high for the development of "alps" as in Europe. Truck gardening and fruit raising are increasing in importance in the valleys well supplied with roads.

The Great Valley Soils in Tennessee and Alabama. The soils of the Great Valley in Tennessee belong to the Red Soil group. The parent soil material in much of the Valley has been derived from dolomite. It is gravelly and stony, leaches actively, and if in ridges washes badly. Mature soils are scarce. Sandstone, shale, and marble have also contributed soil material. Flat lands are, as has been stated, formed where shale and marble are the bedrock. The most potentially productive soils are on the flat, moderately drained lands. Most of these soils are a dark red, almost as dark as hematite ore.

Limestone Soils. The valley soils of Virginia, developed from limestone, are residual, like those of the Bluegrass region and the Nashville basin, are gray brown in color on the gentle slopes. They have the other characteristics of Gray-Brown Soils. These are among the most productive in the South. In both Kentucky and Tennessee the soils are rich in phosphate.

Plateau and Highland Rim Soils. The Cumberland Plateau soils are light in color and texture. The parent material was derived largely from sandstone but some was derived from siliceous shale. In Alabama the color is a light gray, in Tennessee a darker gray. The farmers in the Allegheny Plateau in Kentucky and West Virginia are largely tilling valley soils, some of which are developed from material washed from the hill slopes and mixed with residual limestone silt. So varied are the topography and the source of soil-making material that generalizations do not give a true picture of the soil conditions.

Some portions of the Highland Rim Plain, like the broad plains about Bowling Green, Kentucky, have highly productive soils, the parent soil material having been derived from limestone; but a large part of the Highland Rim region is in slope so steep that erosion and leaching are rapid. Taken as a whole the soils of the Highland Rim are to be classed as indifferent to poor in quality.

Some parts of the Ozarks resemble the Appalachian Plateau region in topography and soils. There are, however, here and there very excellent limestone valleys that are highly productive.

The Loessal Area. A large area of loessal soil some 15-40 miles wide extends along the eastern edge of the alluvial valley of the Mississippi from the Ohio to within a few miles of Lake Pontchartrain. Loess is found here and there on the west side of the Mississippi Valley, but it is only in patches. It is believed that the material of these relatively fertile, fine-textured, buff-colored, silty deposits, so well seen in the bluffs and borders of ravines at Memphis, Vicksburg, and elsewhere, was brought southward from the glaciated area by the river, deposited in bars, and carried by winds to the bluffs bordering the valley. Loessal soils are adapted to intensive cultivation, truck gardening, and the raising of small fruit. The loessal province is an area of well-tilled soil with little unused land.

Soils of the Arid Lands. All the western part of Texas and Oklahoma lies in the Great Plains region, the parent soil materials of which are derived from the weathering of sedimentary rocks, chiefly by mechanical processes. Since chemical decomposition and solution have not been active, the soils have almost the same mineral constituents as the bedrock. These soils are classed by soil students as pedocals. They have a calcium layer near the surface in the black and chocolate-colored soils. In the gray soils of southwestern Texas the calcium layer comes to the surface. Both the black (Chernozem) and the Dark Brown Soils are in themselves productive. The dominating factor in agriculture, however, in this portion of the South, is not soil but climate. The chief problem of the agriculturist is moisture control. (The problem of the agriculturist in the dry lands of the United States is discussed in Chapter 16).

Alluvial Soils. The largest alluvial area, along the Mississippi River from Cairo to the Gulf, 550 miles or more long, 75–100 miles wide, has soil as productive as the famous plains of Mesopotamia and possibly the Nile Valley. The Colorado, the Brazos, Red, Arkansas, and many shorter rivers to the east have in the aggregate many thousands of square miles of alluvial lands. The soils vary from clays and silt loams to sand and gravel. There is little gravel, however, in the flood plains of the larger rivers. The mineral composition of the alluvial soils varies greatly in the different valleys. In general, the soil material is well mixed lithologically, for the material deposited in the flood plains of the larger rivers comes from diverse physiographic regions. Soil students class most alluvial soils as immature and potentially not as productive as soils on the uplands of gentle slopes. The high yields of alluvial soils are probably due to the abundance and availability of soil water.

Factors Affecting Soil Fertility. Although a statement as to the relative fertility of the soils of North and South, considering the areas as a whole, is difficult to prove and needs many qualifications, we know that the North is more productive than the South, and most soil students would attribute this to the higher fertility of the soils.

The soils of the South are almost entirely the result of chemical weathering. Reds, browns, and yellows predominate in color, showing active oxidation. Most of the area of the South is in slope and is subject to surface wash and rapid drainage and leaching. The mild winters permit soil wash and leaching to continue, over most of the South, 12 months in the year. In most parts of the Northern States the soil is a sheet of frozen solid rock, as impervious as a slab of slate, for 4 or more months each year. There is, in general, less humus in the soils of the South than in those of the North, for the high temperature dries out the ground and "burns out" the humus. Southern soils, in general, are lighter in color than those of the North. As an evidence of low fertility of the soils of the southern states, one may point to the fact that farmers, to secure profitable fields of crops, are forced, in many areas, to use large quantities of fertilizer. In 1951 the farmers of the North used 4,634,000 tons of fertilizer, and those of the South 10,900,000 tons.

The Climatic Factor. But there are conditions, other than mineral composition and physical conditions of soils, that influence the productivity of a region. One of the more important factors is climate. Soil students of today have come to realize that climate has a strong influence on the character of the soil (as indicated above), besides being a factor operating on the plant itself, influencing the activity of the protoplasm, the rate of photosynthesis, the rate of transpiration, and the water content of the cells.

The South is a favored section of the country when the climatic elements that affect plant growth are considered. Of all the climatic factors, rainfall and temperature are the two most important.

The Abundant Rainfall. More than three-fourths of the area of the South receives 40 or more inches of rain each year, and three-eighths of the area gets 50 or more inches. About 8 per cent has less than 20 inches, and 16 per cent less than 30. Of the 902,000 square miles in the South, about 120,000 square miles must be classed as semiarid, where agriculture is profitable only by employing moisture-conservation methods and where cattle and sheep raising is the dominant phase of land utilization. Eastward from the 30-inch isohyet, humid agriculture is everywhere possible.

The rainfall is well distributed throughout the year (Fig. 6). Western Texas, most of the Gulf region east of Texas, and the South Atlantic States, including West Virginia, receives 30–40 per cent of their rainfall in June, July, and August. In Central Texas and most of Oklahoma and Arkansas, spring rains are the rule, about 30 per cent of the annual rainfall coming in March, April, and May. Over most of the remainder of the southern states a late summer minimum is the tendency, yet the driest month, on the average, differs from the wettest by only 2 or 3 inches. Texas and Oklahoma, bordering the arid lands of the West, are subject to long spells of dry weather; 2, 3, and even 4 months of drought are common experiences. Droughts do occur in other sections, and there is rarely a year that crops are not retarded in their growth by dry weather. Widespread crop failures east of the semiarid region are of rare occurrence.

The Temperature Regions. With a latitude extent of 15° or 1000 miles, and altitudes varying from sea level to 5000 or 6000 (Mount Mitchell, 6684) feet, there is scope for a wide range of temperature conditions in the South. (Review the temperature-region map of North America, Fig. 4). The most important temperature condition affecting agriculture is the long growing season and the early advent of spring. How man has adjusted his agriculture to these factors is discussed in the following sections.

In a large part of southern Florida and southern Texas, crops are grown the year round. In a strip of country bordering the Gulf, 50-75 miles wide, there are, as a rule, no frosts between March 1 and December 1. All of the Lower South has at least 7 months of growing season and, except for the mountain-plateau areas, all of the South has at least 6 months.

Effect of Passing Highs and Lows. Although the Southern States lie to the south of their major paths, the passing Highs and Lows have general effects as far south as the Gulf. The low relief of the Great Central Plain, extending northward from the Gulf, permits the free passage of air, warm from the south, cool or cold from the north. The presence of a well-developed, slowly moving High in the central United States in the winter often brings freezing weather to the Gulf Coast and far into Florida. At such times great harm is done to vegetation and crops, and consequently cold spells have been closely studied and recorded. The earliest recorded freeze occurred in January, 1766, when fruit trees were killed in St. Augustine. Probably the coldest weather that has ever been felt in Florida occurred February 7, 1835, when the temperature at Jacksonville fell to 7° below zero, the St. John's River had ice on its borders, and all fruit trees were killed. Only since 1871 have official records been kept. Since then freezing weather has occurred in central Florida many times. Since the citrus fruit industry has reached the commercial stage disastrous frosts occurred in 1886 and in 1894, and quite serious damage has occurred in more recent years. Western Texas also suffers greatly from "cold spells." A "norther" in western Texas is a phenomenon always dreaded in the winter. People suffer greatly, and even cattle on the open plains are frozen by the hundreds.

Optimum Conditions for Plants. In most parts of the South, east of the 100th meridian, the conditions for plant growth, insofar as climate affects them, are particularly favorable. In fact, in neither of the other major divisions of the United States—North or West—is there such a large area in which the climatic elements—rainfall, temperature, evaporation, humidity, and length of season, considered as a whole—approach the optimum that they do in the Southern States.

THE LEADING CROPS

Classification of the Crops. A great variety of crops are grown in the South. For purposes of discussion we may divide the products associated with southern agriculture into four large groups:

1. Crops grown for the early markets of the North. In this group are included garden truck, strawberries, bush fruits, and peaches.
2. Crops that are better adapted climatically to the Northern States but are grown in the South largely as supply crops and rarely on a commercial scale. In this group may be placed corn, wheat, oats, barley, hay and forage, apples, and also a large part of the products of the livestock industry.
3. A crop such as tobacco, which has a wide range of distribution, that grows in a belt or zone that overlaps both North and South but has its greatest areal extent in the Southern States.
4. Crops distinctly southern in their distribution, such as cotton, sugar cane, rice, peanuts, pecans, and citrus fruits. California, because of its southern location and its mountain-rimmed valleys, produces all of these, but in none except citrus fruit does it approach the South in quantity.

The First Group of Crops

Early Vegetables. The early advent of spring, the rapid warming of the light, well-drained soil of the Coastal Plain, the short season needed for the development of vegetables and small fruits, rapid transportation, and refrigeration enable the southern producers to monopolize northern markets before Northern competition begins, and this is for about 6 months of the year.[1] Early in January, even before New York and other northern cities have experienced their coldest weather, southern Florida and the Texas Coastal Plain near the Mexican border begin their shipment of quick-maturing, cool-weather vegetables. For 10 to 30 days they enjoy the monopoly, and the New York City housewives pay fancy prices for a handful of radishes, onions, lettuce, or peas that have made a 1000- or 1200-mile journey in a refrigerator car or airplane (Fig. 119). The monopoly is not complete, however, for the high prices that vegetables command at this time of year in northern markets has stimulated many northern gardeners to produce hothouse lettuce, spinach, and a few other vegetables that call for only a small space to grow successfully.

By late January and early February, northern Florida and perhaps southern Georgia, if a January or February "cold spell" has not delayed growth or killed the plants outright, usurps control, supplanting the regions to the south, for freight charges to markets are less. As the season advances farther northward, the Savannah-Charleston regions, next the Wilmington, the lower Chesapeake, and finally the upper Chesapeake and Delaware Bay areas, each in turn has the monopoly, for a brief period, until northern New Jersey and Long Island assume control.

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[1] Vegetables "grown for home use" are not considered in this discussion.

The centers of production of early vegetables in the South are southern and north central Florida, south central Mississippi, southern Louisiana, Savannah, Charleston, the coastal plain of Virginia, Maryland, and Delaware. Railroad and fast steamship lines to large northern cities have an important influence in the localization of trucking areas for early vegetables. The Illinois Central, the Southern Railroad, and the Atlantic Coast Line carry the bulk of fruit and vegetables to the North.

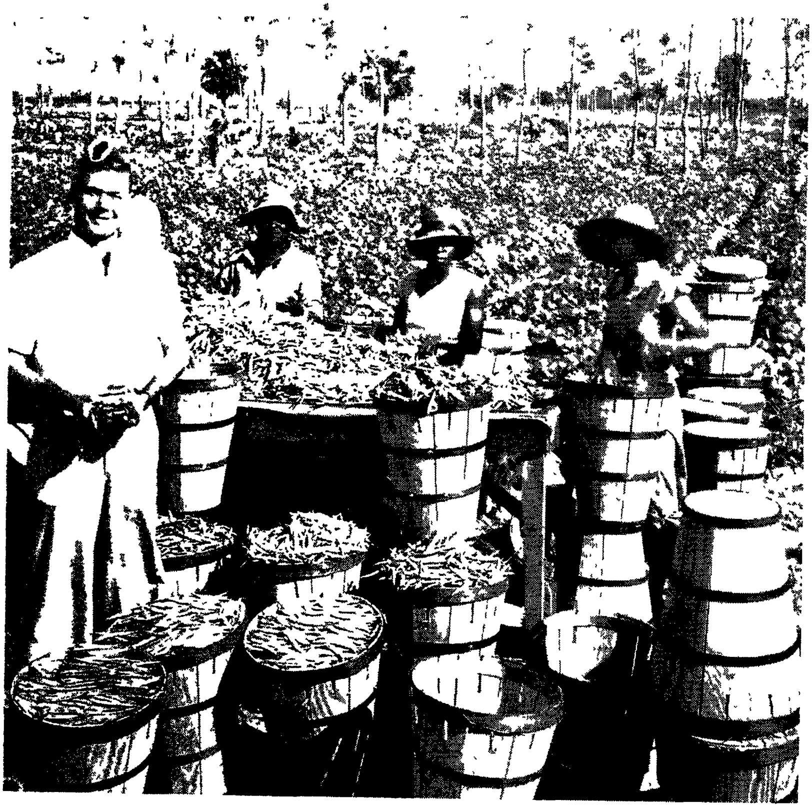

Fig. 119. Picking string beans for northern markets near Ruskin, Florida. *Courtesy, Tampa Chamber of Commerce.* The growing season here is nearly 12 months, and sometimes 4 crops of vegetables a year are possible.

The Effect of Soil on Time of Maturing. All the early vegetables are raised on the well-drained, light, warm, dry sands. These soils are not fertile and, unless fertilized heavily, produce a poor quality of vegetable that is likely to deteriorate in shipment; yet the rapidity of growth on these soils offsets these adverse factors. The relation of latitude and quality and character of soil to market period is shown in Table XI. Each

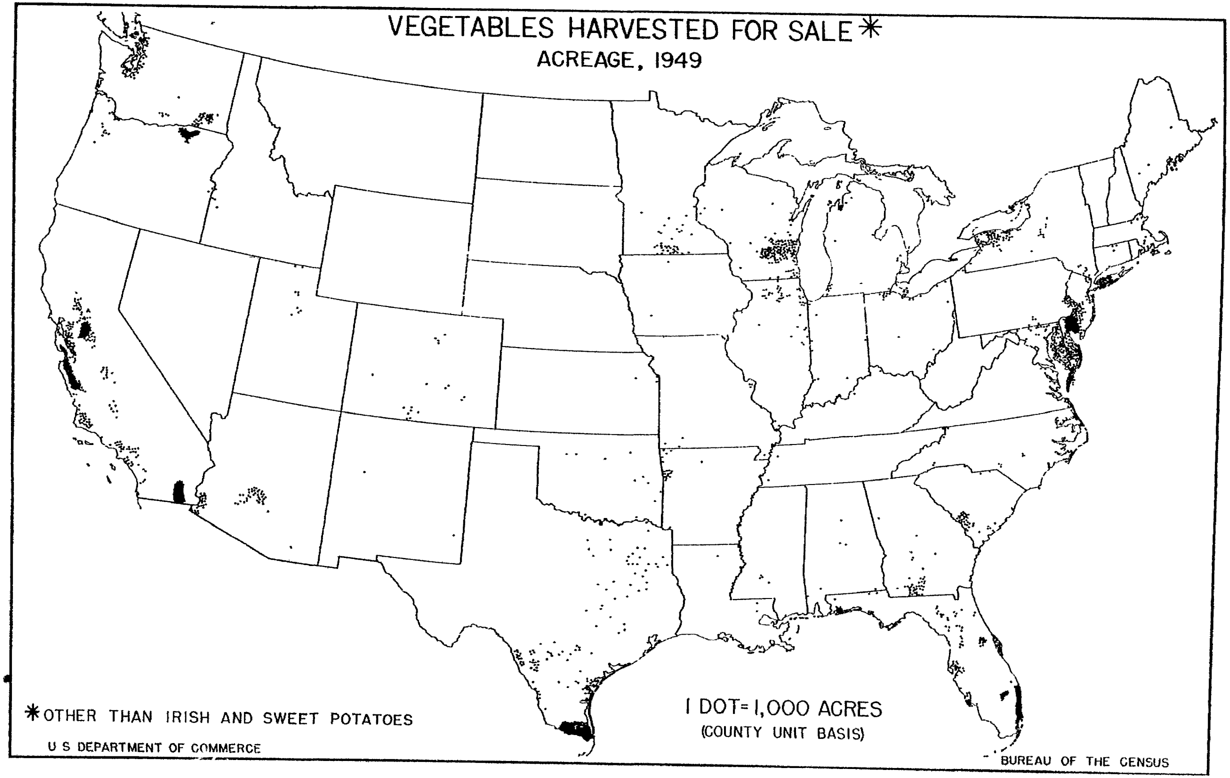
VEGETABLES HARVESTED FOR SALE *
ACREAGE, 1949
* OTHER THAN IRISH AND SWEET POTATOES
1 DOT= 1,000 ACRES
(COUNTY UNIT BASIS)
U S DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Fig. 120. The distribution of acreage of vegetables harvested for sale in the United States

of the regions named in the table enjoys a monopoly of northern markets for 10 to 15 days, for vegetables grown on the same types of soil.

TABLE XI. Market Periods for Fresh Vegetables*

	Jan. 15-31	Feb. 1-15	Feb. 15-28	Mar 1-15	Mar. 15-31	Apr. 1-15
Fla. and Ga.	Sand	Fine sand	Sandy loam	Fine loamy sand	Loam	Silt loam
S.C.		Sand	Fine sand	Sandy loam	Fine sandy loam	Loam
N C.			Sand	Fine sand	Sandy loam	Fine sandy loam
Va.				Sand	Fine sand	Sandy loam
Md. and Del.					Sand	Fine sand
L.I.						Sand

**Bulletin* 96, U.S. Bureau of Soils.

Texas, Louisiana, Mississippi, and Arkansas hold the monopoly of the city markets of the North Central States longer than do truck-garden regions on the Atlantic Coastal Plain, because little competition is offered by the states between the North Central markets and the Gulf Coastal Plains.

The raising of truck products for early markets is a precarious venture for the Coastal Plain gardener, for the period of market control on which success depends is brief, and local cold spells or heavy rains may so delay the period of maturing that regions to the north, if not so affected, may capture the markets. Markets are frequently glutted. The cost of production is high, and the yield of the earliest vegetables, which must be grown on the light, warm, sandy soils, is low unless large quantities of fertilizer are used. The money returns vary greatly; some years large sums are made, other years many face seeming failure; but, as in treasure hunting, no one knows when success may come, hence the gardeners stick to the hoe. The cities of the South offer a market for both early and late vegetables, but their aggregate population is not large.

The Rank of the South in Vegetable Growing. In number of acres used in the growing of vegetables offered for sale, exclusive of potatoes, the South Atlantic States led all other sections, chiefly because of the large area of the Coastal Plain included in this division and the long time each year during which the truck gardeners dominate northern markets. The census data do not distinguish early vegetables from late. We know, however, that, in spite of the high prices paid for early vegetables, the total production of late vegetables, measured in dollars, is far greater than that of the early, for summer is the chief vegetable-eating season. In the value of vegetables raised for sale the South Atlantic Section stood second in 1950, with California leading (Fig. 120).

In comparing individual states, only Texas, Florida, Maryland, and Georgia, in the Southern States, stand out as leaders in vegetable production. No other state of the South exceeds any one of the Middle Atlantic or the East North Central States. California leads the nation in acreage devoted to vegetables, followed by Texas, Wisconsin, New York, and Florida. Both Texas and Florida have made very rapid advances since 1930.

There were few vegetables raised for early markets in the South prior to 1865, and few small fruits and nursery products, because the population was scarce. There were no large southern cities to serve as markets, and labor was needed for cotton, rice, and corn. Furthermore, Negro labor was considered not intelligent enough to till and care for vegetables, and transportation was so poor that markets in large cities could not be reached. The value of vegetables and fruits as foods was not appreciated, and refrigeration was unknown until 1875. Since 1940 there has been great development in truck gardening and in the number of varieties of vegetables. In the areas producing commercial vegetables, commercial varieties, which will stand shipping and look well at the end of the journey, dominate. In many sections a variety of truck is raised, for there is less chance for failure; yet certain of the areas have found it profitable to specialize.

Climate and soil are favorable factors in truck gardening, but the great distance to the northern markets for early vegetables, the small urban population in the South, and the low per capita consumption in the South limit the industry.

Strawberry Growing. Strawberry growers in the South who seek early northern markets have many of the difficulties of the truck gardeners. The annual production varies greatly. In the South the average crop is 100,000,000 quarts, but in 1944, a short crop year, the South produced only 38,000,000 quarts, and the entire northeastern area and the northern states were also low in strawberry production in 1944. The leading states in strawberry production in 1950 were California, Arkansas, and Louisiana, in the order named. The South produced more than 50 per cent of the nation's crop.

Peach Growing in the South. In Georgia, northeastern Texas, Arkansas, central Oklahoma, North Carolina, and Virginia most of the peaches of the South are raised. These and several minor regions have about 50 per cent of the peach trees of the country, and produce about 30 per cent of the crop. California alone, however, produces about 39 per cent of the total for the United States (Fig. 121).

Even when the Spaniards held Florida, there were large peach orchards in that state and elsewhere in the South. From these orchards stock was secured for the peach orchards found on a large number of southern plantations until after the Civil War. Careful selection and favorable soil and climate have preserved or even enhanced the color and flavor of the Spanish variety. It is still a favorite.

About 1870–1875, the first attempts were made to place Georgia peaches on northern markets; but this was before the days of special fruit trains, refrigerator cars, and scientific methods of packing. Many experiments were tried, but almost always the reports to the shipper were the same, "spoiled in transit." Finally the refrigerator car solved the problem, and in 1889 the first large peach crop was successfully marketed. The planting of peach orchards soon became active in many parts of Georgia. Many failures resulted through lack of knowledge of air drainage, adaptation to soil, and adaptation of variety to conditions. Experience has taught that the hill slopes in northwestern Georgia in the Great Appalachian Valley are suitable, and here is found a large acreage; but the leading peach region has come to be central Georgia, to the southwest of Macon, centering about Fort Valley and Marshallville. These towns are on broad interstream uplands with plenty of slope. The peach region of Georgia is shifting northward to the hill lands on the outer edge of the Piedmont, and into the old cotton-growing section of the Piedmont in South Carolina.

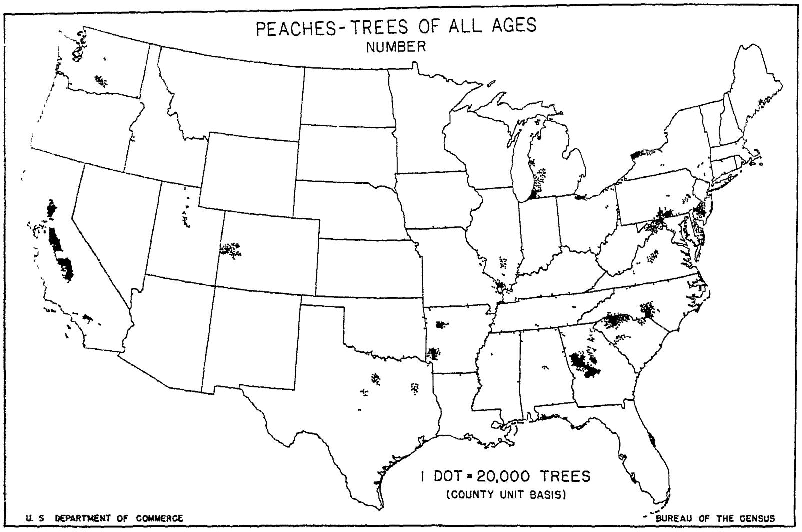

Fig. 121. Number of peach trees of all ages in the United States. *Courtesy, U. S. Department of Agriculture.* Peaches are widely distributed in the United States. Since about 1910 Michigan has entered into commercial production of this fruit. Georgia had three-fourths as many trees as California, yet California produced more than five times as many bushels.

Peach growing in the South is not without its losses. On the average, 1 crop out of 3 or 4 is lost by late frosts. The warm days of late February and early March may start spring growth in the trees in central Georgia and Texas—slightly later farther north—and killing frosts may come as late as April 1. Because of the long budding and blossoming season, many blossoms or buds usually escape the 1 or 2 days of cold weather, and enough peaches will mature to make a paying crop. In comparison with California, the yield per tree is low. Georgia has nearly as many bearing trees as California, yet the yield is less than one-third as many bushels. The yield per tree, however, in Georgia is higher than in most of the northern states. There are, of course, factors other than geographic ones that influence the output of orchards. The Georgia Fruit Exchange, with agents in many cities, and the active cooperation of the railroads assist the producers in getting their product on the market at opportune times. About 85 per cent of the peach growers belong to the exchange.

The Second Group of Crops

Little need be said about the second group of products, for a discussion of these belongs properly in the sections devoted to the Northern States. Any of the cereals will grow over a large part of the South. Barley and oats are sown for winter cover crops and pasturage and for plowing under. Wheat, confined chiefly to the Upper South, is ground in local mills, mainly for local consumption. Corn is widely distributed, cornfields being found in every part except in the lower Mississippi delta, east Gulf regions, and most of Florida. Yet Illinois and Iowa together in 1950 produced considerably more than the crop of the entire South. Much corn is consumed as human food, the per capita being much greater than in the North; but because of the relatively slight importance of livestock in southern agriculture there is not the demand for corn that there is in the Corn Belt. The South has a large area in which the climate is nearly, if not quite, as good as in the North. Some of the largest "corn club" yields have been produced in the South, which leads one to venture the opinion that with better tillage and attention to seed selection the returns might be greatly increased. The heavy rainfall and high temperatures tend to develop more stalk and leaf than in the North, and often this growth is at the expense of the kernels.

Apples have long been grown in the South, but only since about 1860 have commercial orchards been planted. Planting is still in progress. The chief producing orchards are on the ridges of the Appalachian Valley and on the Blue Ridge in Virginia, in the Southern Appalachian Mountains in North Carolina, and in northwestern Arkansas in the Ozark Plateau. The apple-growing regions of the United States do not extend southward much beyond the middle South. About one-third of the bearing apple trees in the country are in the South, but the total production is generally less than one-fourth.

Southern Livestock Industry. Even today the South ranks well among the other sections of the United States in the livestock industry, the value of southern livestock being about 25 per cent of the total for the country. Little attention has been paid to the raising of blooded or special-purpose stock until about 1930, although a few planters have all along raised pedigreed horses and cattle. Kentucky and Tennessee have long bred race horses, an industry well adapted to the Bluegrass soils. It is claimed by many that bluegrass is the ideal pasture for the horse (Fig. 122). In the early part of the nineteenth century, Devon and Shorthorn cattle were brought from England, but in most parts they were crossed with other breeds. Strains of these may still be seen among the "scrubs" in some sections.

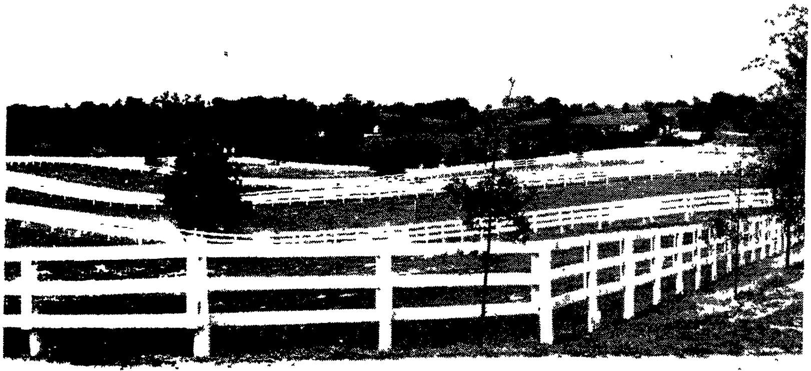

Fig. 122. A typical landscape in the Bluegrass region of Kentucky, on residual soils developed from limestone. *Courtesy, Lexington Herald-Leader.* Here the paddocks are enclosed with board fences instead of wire, as a protection against possible injury to horses. This region has long been noted for the breeding of the American thoroughbred trotting, pacing, and race horses.

The raising of cattle has been easy, and little attention was formerly given to the maintenance of quality. Since earliest colonial times it has been the general practice to turn cattle, and hogs, also, free to range the forests for a living. In colonial times they were not herded, as in New England, by public herders, but were "branded" and allowed free range, and once a year "round-ups" were held and the increase allocated. The loss of cattle was considerable. Flint writes that in pre-Revolutionary War days the planters expected that such "multitudes" would die each winter as to "supply hides enough for shoeing the negroes on every farm." This was a matter "generally and constantly anticipated."

Nature developed two distinct varieties of cattle in the South, the Texas "longhorns" and the "piney woods" cattle. With them may be classed the "razor back" hog. They do not conform to man's ideas of special-purpose animals, but are not to be classed as degenerates. They are the product of nature's breeding. All "purebred stock" needs the watchful care of man. These so-called "scrubs" will thrive better in their environment than the pampered product of man's careful selection.

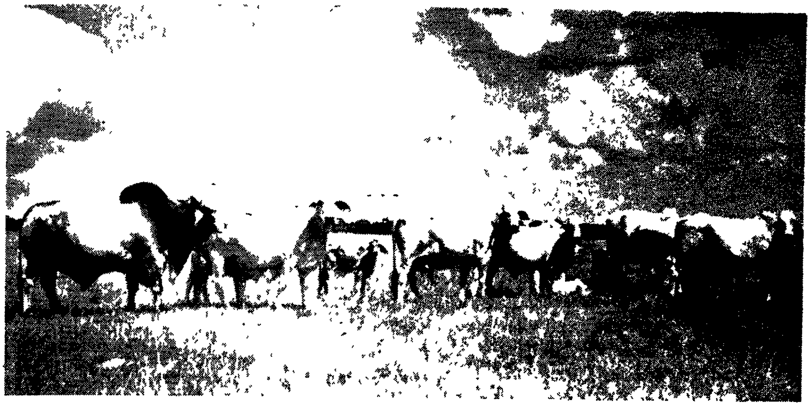

Fig. 123. Herd of Brahman cattle on the Texas Coastal Prairies. *Courtesy of Hudgins Ranch, Hungerford, Texas.* The introduction and crossbreeding of Brahman cattle with native stock produces animals more nearly immune to tick fever—a promising aspect of the beef cattle industry in the South.

The days of the so-called "scrubs" in the South are numbered. Nearly all the "longhorns," some with a spread of horns of 8 feet or more, disappeared by 1885. There are still large herds of "piney woods" cattle and a few "razor back" hogs. "Round-ups" are still held in the cut-over regions of the Coastal Plain, but commercial clubs, chambers of commerce, banks, railroads, state agricultural colleges, county agents, and farm journals have in many places educated the southern farmer to the value of blooded stock. Only a beginning has been made, however. The first public sale of pure-bred cattle in the South was held in Oklahoma City in 1903, and the second sale in 1904 at Auburn, Alabama. Elsewhere many more have been held each year. The South lacks packing houses, but some have been established at Fort Worth, Nashville, Macon, and elsewhere. Creameries, condenseries, and cheese factories are becoming more numerous. The long grazing season, large area for cattle ranges on the cut-over lands of Coastal Plains and mountain slopes, and the abundance of the more concentrated foods, as cottonseed and peanut meal, ensilage, and leguminous plants are conditions that will not long be overlooked. The tick, the most important barrier to livestock raising in the past, is now being controlled.

On the Texas Gulf Coastal Plain introductions of Brahman cattle for crossbreeding has produced a variety more nearly immune to tick fever than uncrossed breeds. Today some large herds are to be found in the longleaf pine forests of northern Florida, in the thornbush section of the southeast coast of Texas, on the coastal prairies of Louisiana, as well as on the grassy coastal prairies and forest lands of east Texas.

The Gulf Coastal Plain with large areas of range land and grasses, a mild winter, with plentiful rainfall, and high prices for beef, is undoubtedly due to expand its cattle industry (Fig. 123).

The Third Group of Crops

Tobacco in the South. Tobacco, a product common to both the Northern and Southern States, is, after all, a southern crop. About 90 per cent of the product of the country comes from the South, and Kentucky alone produces more than twice as much and North Carolina nearly five times as much as all the Northern States combined. The yield to the acre in pounds is on the average only about 50–70 per cent of that in the Northern States.

Like corn, tobacco is a gift of the first Americans to our European ancestors who colonized the continent. At one time, tobacco raising at Jamestown was so profitable that the borders of the streets were planted and the production of food crops was neglected. From the Chesapeake Bay region tobacco culture was carried southward and westward. It was finally found that the best environment for the plant is in central Kentucky, southern Virginia on the Piedmont, northern and eastern North Carolina, and eastern South Carolina, chiefly on the Coastal Plain. These are the more important tobacco-growing centers of the United States (Figs. 124 and 125).

At present, tobacco is a product chiefly of the small farm, and only a few acres on a farm are devoted to it. Its culture on many farms is a family affair, and one family of average size is able to raise 5–10 acres. In North Carolina and Kentucky, the average size of the patches is less than 5 acres. On some of the large farms where labor is employed for general agriculture, the tobacco fields often have 20–30 acres per farm.

how much cotton the South can produce, but how much the market will take.

The Rice Crop. The native home of rice for thousands of years has been eastern and southeastern Asia, where the summer temperatures are high and the rainfall is heavy. Asia continues to produce a large part of the rice crop of the world. In 1947 it was estimated that Asia had 191 million acres in rice, whereas the acreage in the United States was less than 2 million. Nevertheless, rice is an important crop in parts of the South. In the United States, a similar environment to that in parts of Asia, except that the season is not quite so long, is found along the Gulf and Souh Atlantic coasts and in the alluvial valley of the Arkansas and Mississippi.

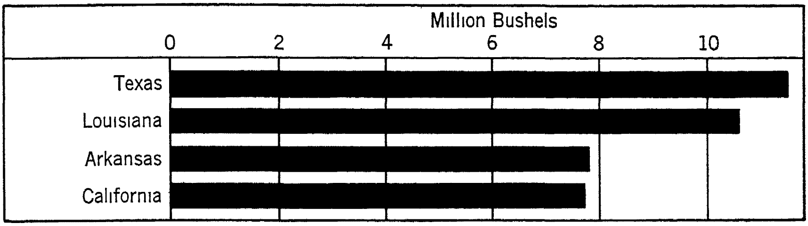

Fig. 129. Rice production in the United States by leading states in 1950.

In 1950, the leading states in the Union in rice production were Texas, producing 27,600,000 bushels; Louisiana 26,500,000 bushels; Arkansas and California each over 19,000,000 bushels; Mississippi, South Carolina, Georgia, and a few other states of the South produce small quantities. The rice crop of the United States in 1950 was over 90,000,000 bushels, about 85 per cent coming from the South. California is the only state of importance outside of the South; it ranked fourth in production in 1950 (Fig. 129). There are possibly 20,000,000 acres in the United States that may be devoted to rice culture. The low per capita consumption in the United States is the chief reason for low production.

The culture of rice in the South reached a peak in 1850, when nearly 6,500,000 bushels were grown; 3,300,000 in South Carolina, 3,100,000 in Georgia. Carolina rice had a good reputation in Europe. One author in London wrote, "By far the best imported rice is from South Carolina. It is larger and better tasting than that from India, which is smaller, meager, and often broken." The cultivation of rice raised by the help of slave labor brought great prosperity. Men grew rich, built fine homes, and educated their children in northern and European schools, from the fields of rice. Rice growers were the leading agriculturists of the South in the use of scientific methods—rotation of crops and the use of fertilizer.

During the Civil War the industry was almost destroyed. The canals became filled with swampy vegetation, the fields were neglected, and the planters emigrated to the interior. In 1890 the growing of rice was reestablished in South Carolina and Georgia, but by that time it had begun to be grown in the west Gulf lands by irrigation methods. In 1879 South Carolina Produced 1,873,000 bushels; Georgia, 900,000; and Louisiana, 800,000. By 1889 Louisiana took the lead, the crop being 2,700,000 and that of South Carolina but 1,000,000 bushels. By 1909 rice growing in the South Atlantic States was of little importance. Since 1940 rice growing has extended along the Gulf Coast of Texas and into the Arkansas Valley. Probably the most recent extension of rice culture is into the St. Francis Basin of northeastern Arkansas, where level land permits the use of machinery and water is pumped from deep wells, with relatively little expense[2] (Fig. 130).

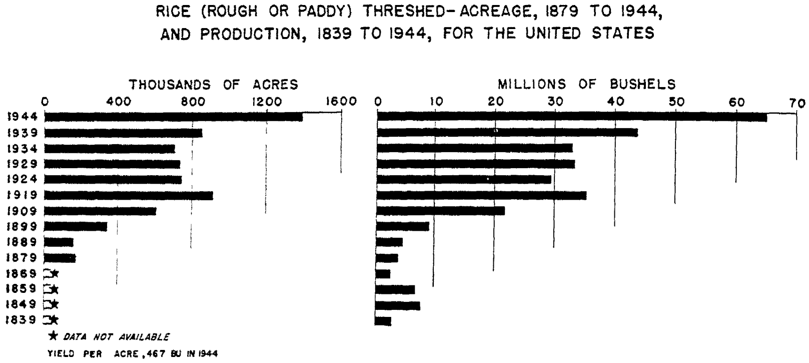

Fig. 130. The trend of rice production in the United States.

Rice culture in Louisiana, Texas, and Arkansas is much like wheat culture in the grain states of the North. The application of grain machinery to rice culture by farmers from the Middle West since the 1880's make the growing of this oriental cereal on a large scale possible. Here one finds irrigation practiced in a region where the rainfall is sufficient for other humid-land crops. The water is pumped from the bayous or wells, or furnished by flowing wells, and distributed over the land, much as it is in the arid sections of the West. The flatness of the Coastal Prairies, the great depth of soil, and its looseness make the construction of distributing channels easy. Low levees are, as a rule, thrown up about the borders of the patches of ground, sufficiently high to hold the waters yet low enough to permit the free movement of farm machinery over them.

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[2] A well near Paragould, Arkansas, 1000 feet deep, pumped by the power of a gasoline tractor, furnishes a 10-inch stream of water, nearly 2,000 gallons per day, to irrigate 80 acres of rice.

The land is plowed and harrowed and the seed is drilled in by the ordinary grain drills used in grain fields. After the small plants reach the height of an inch or two, the fields are flooded and kept flooded throughout the greater part of the growing season. When the heads of rice are nearly formed, the fields are drained and allowed to dry out. This decrease in moisture hastens the maturing of the seed and gives a firm bed for the heavy binders that harvest the crop. In September and October when the harvesting and threshing season is on, the rice farms remind one of the wheat lands of the North Central States, with binders, rice stack, and threshing machines, except that Negro labor is doing most of the work.

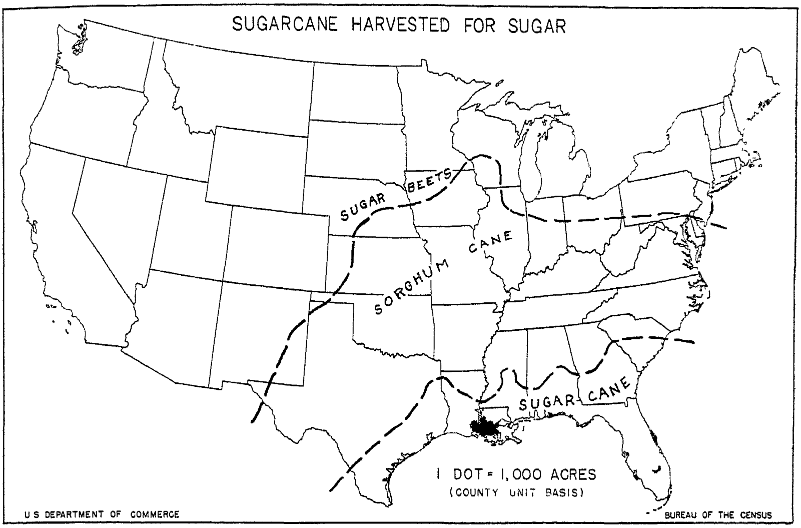

Fig. 131. Sugar cane harvested for sugar, and other sugar areas in the United States. Louisiana grows most of the cane from which sugar is produced in the United States; however much cane is grown for syrup in the Lower South. Sorghum cane is grown mainly for syrup and little, if any, for sugar. The approximate limits of beets, sorghum, and cane are shown on this map. The canes, particularly sugar cane, require the longer seasons. Louisiana truly contains the "sugar bowl."

Sugar in Louisiana. Although sugar cane is grown for sugar in 8 of the Southern States, Louisiana produces nearly the total commercial crop. Even here, but for the tariff barrier to foreign sugar, the industry could not exist. Sugar is a crop that does best only in the tropics and must be produced on a large scale, for the mills used in its manufacture, if they are to produce sugar low enough in cost to meet the competition elsewhere, are necessarily large and costly. All through the Lower South, however, sugar cane is grown on tens of thousands of farms in each state—over 200,000 farms in all—merely for the making of sugar and syrup for home consumption (Fig. 131).

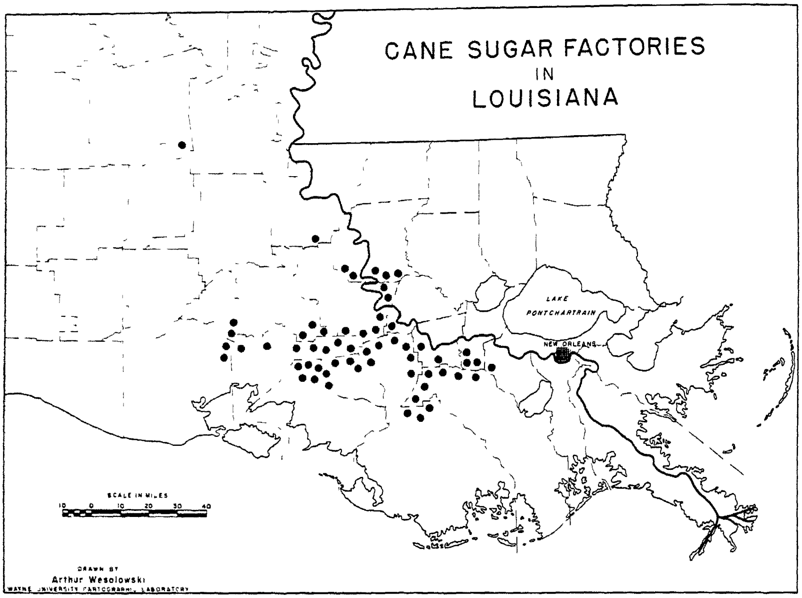

Fig. 132. Cane sugar factories in Louisiana. *Arthur Wesolowski.* In the early history of cane sugar making there were many mills scattered throughout the cane-growing area As improvements were made the refining process became more complex, small mills were not economical, and fewer but larger mills developed. Each mill is now centrally located in a cane-producing area, and all are on the newer delta lands and prairies.

Little can be promised as to the growth of the sugar industry in the South because of the many unfavorable conditions to be overcome by Southern cane growers, such as adverse climate, labor scarcity, competition with beet sugar, and the changing tariff. Throughout most of United States history there has been a tariff on sugar imports, as a protection for the mainland industry. Today there is perhaps more to justify such a tariff because of the useful by-products which come from the sugar mills, particularly in the case of cane sugar. These are molasses and fiber board. Molasses is one of the basic sources of industrial alcohol, as well as a feedstuff for fattening cattle. Fiber board is a building board made from "bagasse," the waste of sugar cane stalks after the juice has been extracted. It is a highly satisfactory building material and an insulator used in refrigerators, as well as a sound absorber used in many ways. The fiber board industry in Louisiana yields about as much profit as the sugar. (Fig. 132).

The United States produces less than one-third of its total sugar consumption (both beet and cane). The remainder comes from the West Indies, Hawaii, and the Philippines (Fig. 133). The Everglades region of Florida has begun sugar production from cane. This area has an advantage over Louisiana in that it is relatively free from frost, and the cane does not have to be replanted each year as is the case in Louisiana. The Everglades could become a large sugar producer, but congressional legislation limits the amount to be produced.

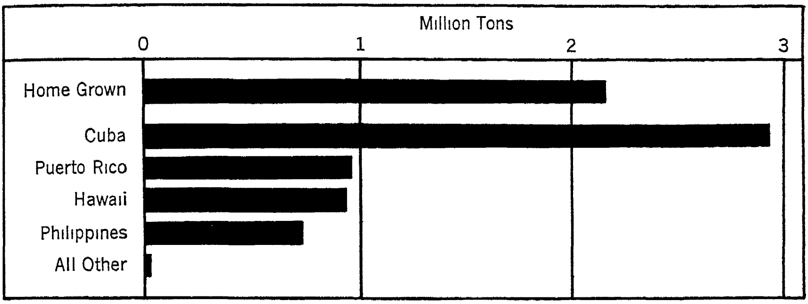

Fig. 133. Sources of sugar used in the United States in 1951. (Three-fourths of all home-grown sugar was from beets; practically all imported sugar was from cane.)

There is so much good, free land in the tropics and the yield is so much better there, that the industry in the South will probably last only as long as it is encouraged by favorable tariff laws.

Citrus Fruits. There is a large area along the Gulf Coast stretching from the Rio Grande to Pensacola that is adapted to the growing of oranges, but only a small part of this region is utilized. Most of the orange groves are in Florida and Texas, south of 29° N. (Fig. 134). It is believed that the Spaniards brought the bitter Seville orange from Europe when they occupied the eastern Gulf Coast regions. Some of these trees have been used as stock for grafting. The modern orange-growing industry dates from about 1875, when the East Coast Railway was completed. At one time Florida dominated northern and eastern orange markets, but severe freezes in 1886, 1894, and 1899 destroyed three-fourths of the plantings and thus gave California an opportunity to win markets. Replanting followed in Florida but not in the northern part of the state. The orange region was shifted southward. In 1929 the Mediterranean fruit fly forced an embargo on the shipment of citrus fruit from more than 8,000,000 acres which grew about 70 per cent of the bearing trees of Florida.

This embargo gave the fruit growers of the lower Rio Grande Valley, which was just producing its initial large crop, a comparatively free market. The production, average for 1940–1949, for the three states (in boxes) is as follows:

	Oranges	Grapefruit	Lemons
Florida	46,070,000	27,280,000	—
California	48,196,000	2,892,000	12,993,000
Texas	3,616,000	17,387,000	—

The yield per tree and the relative value of the crop is generally lower in Florida than in California, owing undoubtedly to poor methods of production and marketing. Only since about 1935 has a Florida fruit exchange done much advertising. In some markets in the eastern United States, Florida and Texas oranges compete successfully with the California product because they can be put on the market at a much lower price. They are sent 1000 miles or more by carload or truckload without boxing.

Fig. 134. Workers in orange grove in central Florida. *Courtesy, Florida News Bureau.*

Grapefruit, or pomelo, grows in much the same region as the orange. In the production and delivery to northern markets, Florida made the beginning and has since retained its leadership. The lower Rio Grande region is now arising as a strong competitor of Florida in pomelos. About 80 per cent of the pomelo trees of the country are in the South; and, if

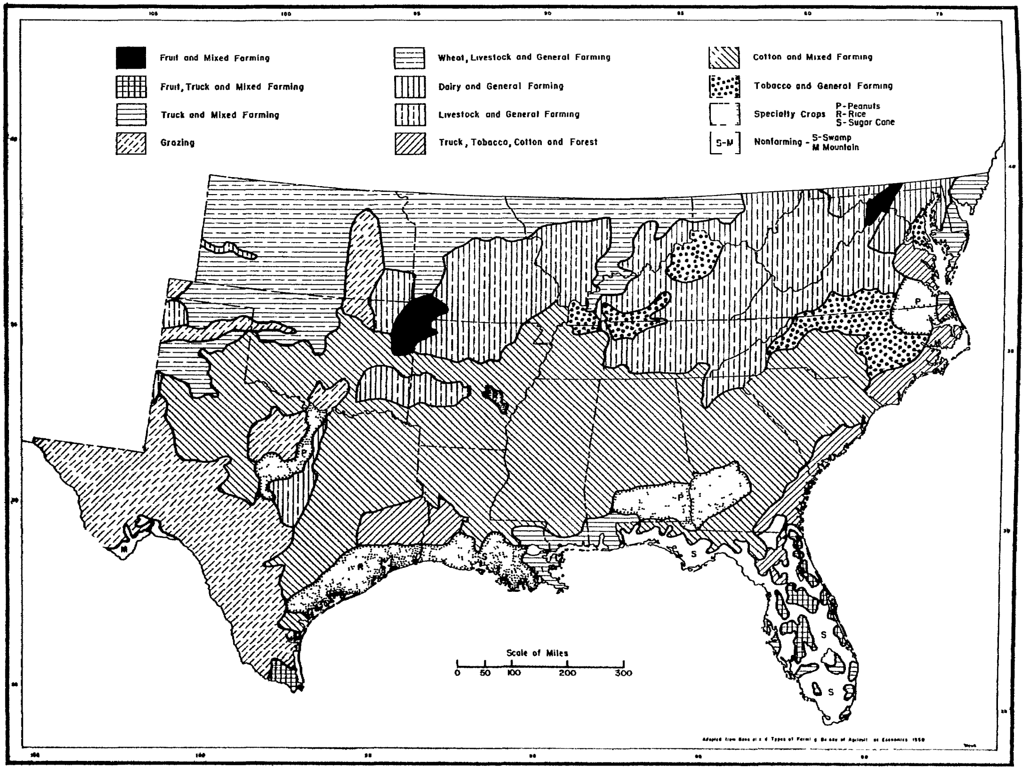
Fruit and Mixed Farming
Fruit, Truck and Mixed Farming
Truck and Mixed Farming
Grazing
Wheat, Livestock and General Farming
Dairy and General Farming
Livestock and General Farming
Truck, Tobacco, Cotton and Forest
Cotton and Mixed Farming
Tobacco and General Farming
Specialty Crops P-Peanuts R-Rice S-Sugar Cane
Nonfarming - S-Swamp M Mountain
S-M
P
R
S
M
Scale of Miles
0
50
100
200
300

Fig. 135. Types of farming in the South. *Adapted from "Types of Farming," Bureau of Agricultural Economics, 1950.*

proper attention is given to marketing and careful cultivation, the South will continue to lead, for it has a great advantage over California, its only competitor, in distance and freight costs. Califorina has a large market on the Pacific Coast and the West in general, but nothing like the one Florida and Texas can command.

Citrus fruit, after all, bulks small when compared with other agricultural products of the South. Oranges, grapefruit, limes, tangerines, and kumquats, in the aggregate, were in 1950 valued at less than $500,000,000, whereas the cotton crop, including seed, was worth more than three times that amount.

Types of Farming. Cotton farming is the dominant type in the Southern States in areal extent; but rarely is cotton the only crop produced on the cotton farms (Fig. 135). Most cotton is grown in combination with one or two or more other products. In western Texas, for example, cotton is produced with some grain sorghum and livestock; in eastern Texas cotton with fruit and truck. In the Black Belt of Alabama cotton raising is combined with general farming and dairying; in southern South Carolina cotton farming with part-time farming and in some areas with self-sufficiency farming; but always in the area shown on the map as cotton farming, cotton represents 40 per cent at least of the value of products. In the cotton combination types, cotton dominates, but forms less than 40 per cent of total value of crops. The combinations vary. In some sections the companion product is livestock, in others peanuts, potatoes, truck, peaches, citrus fruit, pecans, tobacco, etc.

Ranch livestock farming is the dominant type in the western part of the south. Here also is most of the cash grain farming and cash grain livestock. Where are the mixed-farming areas? Where the self-sufficing? Where the general?Where are the non-agricultural lands? In what states is tobacco farming dominant? In the tobacco areas other products are raised but tobacco represents 40 or more per cent of the total products of the farm.

Try to explain the relationship of types of farming in the South to natural environmental conditions and markets.

QUESTIONS, EXERCISES, AND PROBLEMS

1. Some writers claim that the South offers excellent advantages to the home seeker in search of farm lands. Can you justify such claims? Make use of all the needed climatic, physical, and agricultural maps in the text.

2. Make a statistical comparison of agriculture in Mississippi and Iowa. Data may be secured from the Census Report, volumes on agriculture, the *Yearbooks* of the Department of Agriculture, and the *Statistical Abstract.* Compare land areas, population, farm lands, improved farm lands, crops, livestock, automobiles on farms, water in houses, tele-

phones, value of farm property and of machinery, and other items on which you secure data. What are your conclusions? What explanations can you offer for the differences?

3. Select a county on the Coastal Plain of North Carolina (Green County), one on the Piedmont (Guilford County), one in western North Carolina (Harwood County), and compare the agricultural conditions. Secure data from the Census Reports.

4. Make a statistical comparison of agriculture in a county in the Black Belt of Texas (Ellis or Dallas County) with a county in the black-earth section of Nebraska (Adams or Clay County). Write your conclusions.

5 Compare yields to the acre of several crops grown in both North Central and Southern States. What explanations do you offer? Secure data from the *Yearbook* of the Department of Agriculture.

6 To what extent is the South improving its cattle, sheep, and swine by the introduction of pure-bred animals? Compare with some of the states of the North. Does the presence of a large number of Negro tenants have any influence on agricultural improvement?

7. Make a study of share-cropping in the South. How do you account for this practice? What changes are in progress?

8 How do you explain the tendency toward intensification in agriculture in some sections of the South with a population density as low as it is?

9 Classify the several Southern States as to location in the agricultural regions shown in Fig. 135, also as to the dominant type of farming in each.

10. What improvements in the methods and practices of agriculture would you suggest to make the South a greater agricultural section?

CHAPTER 13

Manufacturing in the South

INDUSTRIAL OPPORTUNITIES

Some Comparisons. The value of the manufactured products of the South (16 southern states as listed in the census reports) in 1950 was greater than the output of the factories of the entire United States in 1889, and nearly twice the output of the country in 1879. The aggregate cotton spindles active in Southern cotton mills in 1950 numbered nearly as many as those of the United States in 1900. The South produced more pig iron in 1950 than the entire country in 1880, cut nearly as much lumber, mined five times as much coal, and produced fifty times as much petroleum. Since about 1935 there has been a greater increase in manufacturing in the southern states than in any other section of the country.

This is indeed remarkable progress in industrial development; yet other sections have grown likewise in the last half century. However, it is true that the South is not producing its share of the manufactured goods of the country, when relative areas and populations are considered. Although the South has nearly 30 per cent of the area of the country, and more than 30 per cent of the people, it produces only 18 per cent of the manufactured goods of the country, and the net value is but 17.5 per cent of that for the country as a whole. The Northeastern Region produced about two and one-half times as much, and the north Central States also about two and one-half times as much. New York, the leading manufacturing state, produced three-fourths as much as all of the South (based on net value) (Fig. 136). These comparisons bespeak a retarded development, past and present; yet the progress made since World War I offers great hope for the future of Southern manufacture. *What are the causes for this retarded condition? Should the people of the South be optimistic for the future?*

CAUSES FOR RETARDED INDUSTRIAL DEVELOPMENT

The Dominance of Agriculture. The South traditionally is an agricultural section. In 1950 more than 30 per cent of the farm population of the country resided in the South; and 55 per cent of the people were classed as rural. In colonial days there were here and there in the South, as in the Northern States, small industrial plants of various sorts built to cater to local needs only. As settlements spread westward along the small, non-navigable streams, and especially beyond the mountains, there was a call for local industries, and these supplied all community needs until the coming of the railroad. Such was the condition over all parts of the South beyond the tidewater areas. Except for the invention of textile machinery in England and the cotton gin in America, it seems probable that there would have developed in time an industrial and commercial population along with an agricultural, in such relative numbers as to make each community, or natural trade region, self-sustaining insofar as local resources would permit.

Cotton Becomes King. It was discovered, however, two or three decades after 1793, that great profits were to be made in the growing of cotton. Accordingly, most of the available capital of the South went into land, farm buildings, tools, and slaves. Most industries, unless associated with cotton culture, languished. Before the middle of the nineteenth century cotton production came to exceed the demand. Cotton prices reached such a low level that cotton culture lost some of its glamour. Some capitalists, for a few years at least, sought channels other than agriculture. Some thoughtful men came to realize the ill effects of the industrial dependence on New England and old England; they saw it was bad economy to ship the raw products hundreds of miles to be fabricated, and to have the articles returned and purchased at several times the cost of the raw material, while capital and labor got such low returns in agricultural pursuits. Political antagonism toward the North made this commercial and economic vassaldom all the more galling. But what could be done? The basic economic activity of a country is not to be changed in a day, and agriculture was the dominant activity. The South in 1850 was producing only about 10 per cent of the manufactured goods of the country.

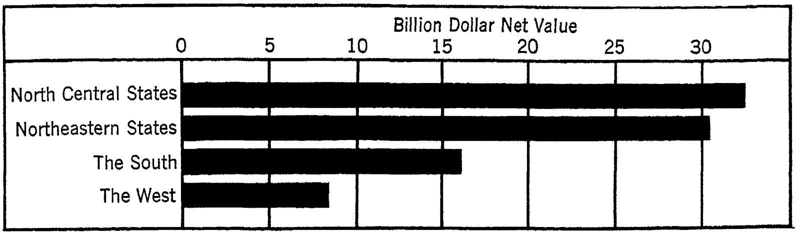

Fig 136. Net value of manufacturing in the United States by geographic divisions in 1950.

Effects of the Civil War. During the Civil War, cut off from the factories of the North and Europe, every available plant in the South was at work producing clothing, food, munitions, railroad equipment, and other articles needed for war. The small factories scattered all over the South were expanded, and other plants built to take care of the emergency demand. By the close of the war, all these factories were idle or had been destroyed. But the South had its land, its abundant rain, genial temperatures, and life-giving sunshine, and these largely came to save it, if saved it was. Its economic life was to be intimately associated with these enduring factors. It again became the producer of raw materials for northern and eastern factories. Its economic affiliations, as well as its political, were again merged with those of the country at large.

Coal and Railroads Gave North Advantage. In the two decades preceding 1870, coal for steam power had come to be an important factor in the industries in the Northeastern States. In 1850 the country at large used 6,250,000 tons of coal; by 1860 the consumption had reached more than 13,000,000 tons; and by 1870 nearly 30,000,000. Nearly all of this was consumed in the North, and a large part in northern factories, which gave this section a decided advantage in the production of manufactured articles. Moreover, railroad consolidation had progressed to such an extent by 1870 that northern manufactured goods had access to southern markets. With the absence of tariff barriers to check the influx of northern-made goods and to protect the young and feeble industries in the South, little progress in manufacturing was made. The trans-Rocky movement of population and capital, initiated by the discovery of gold in 1848 and wonderfully aided by the construction of the transcontinental railroad, was going on apace. In national development and industrial expansion, the South was forgotten by the North and Northeast, the sections best equipped to furnish capital. A few Northern men, however, who had participated in the campaigns in the South, saw great possibilities here and returned at the close of the Civil War with some capital.

In 1870 the factories of the South produced only 6.6 per cent of the manufactured goods of the country; in 1880, only 6.3 per cent; in 1890, 7.5 per cent; in 1900, 9.1 per cent; in 1909, 12.2 per cent, and in 1950, 18 per cent. Thus at no period in its history has the South produced the portion of the manufactured goods that its area and population call for. Its past has been fundamentally associated with agriculture.

Effects of Low Population Density. Another cause for the retarded development is the low population density. It is a well-known principle that the occupations dominant in a country bear a fairly definite relation to the density of population. The countries or sections of countries dominantly manufacturing have high population densities. Belgium as a whole has a population density of more than 711 to the square mile; England and Wales, about 685; Massachusetts, 546; New York State, with fully 90 per cent of its factories concentrated in a narrow strip along the Hudson and Mohawk Rivers and the Lake Plains south of Lake Ontario, and with large areas of agricultural and forest land, has an average density of 281. The average for all of New England is 133, for the middle Atlantic states, 274.

In the South, the states east of the Mississippi have an average density of about 77; those to the west, 40. The most densely populated state in the South is Maryland, with a density of 184; and the lowest is Texas, with 24. The average for the South is only about 59.

In the past the densities of the South have been even lower. Georgia, which may be taken as representing the medium density in 1950, had in 1800 a population density of 1.5. Massachusetts in the same year had a density of 52.6; and Rhode Island, 64.8. At no time in the history of the South have densities approached those of the states of the North and East nor of European countries in which manufacturing has long been active.

Some Reasons for the Low Density. There are several possible reasons for the low population density in the South. Immigration has never been active from the North or from Europe. By the time that the yearly arrival of immigrants from Europe had reached 100,000 or more, just before the middle of the nineteenth century, all the great passenger liners docked at northern ports; and into New York, Boston, and Philadelphia poured by far the larger part of the European arrivals, to collect in the northern manufacturing cities or to move westward to the cities and farms of the Middle West and West. In 1950 about 2.5 per cent of the white population of the South was foreign born. For New England, the percentage was 16; and for the Middle Atlantic States, 17. Former census reports have shown even greater percentages of foreign born in the New England and Middle Atlantic States.

Most students of population phenomena contend that the population of the United States would have been what it now is without immigration, that the presence of the foreign element has hindered the normal population increase of native-born whites. These contentions may be correct, but the sections using foreign labor certainly are benefited by immigration, for a large proportion of the immigrants are beyond the "age of infancy" when they arrive and are thus ready to begin economic production. The South has had to rear all its labor, and thus has been handicapped to some extent as compared to the North and East. Moreover, in the earlier days when the bulk of the immigrants came from northwestern Europe, there were many skilled workmen among them who contributed much to the growth of industry in the sections in which they settled.

In the new movement of population within the country, the South has been passed by, the migrants moving westward. The West had, all along, new and cheap lands. It had mineral prizes to offer, and has great commercial opportunities. It has long been advertised freely. When such a movement of population has once been started, it changes its direction but slowly. The feeling of sectionalism probably has little or nothing to do with the seeming neglect of the South. Economic motives are usually more dominant than political or traditional ones.

The Negro, before and since the Civil War, undoubtedly kept out many immigrants from both Europe and the North. Free labor felt it could not adjust itself to a slavery regime, and after the emancipation of the Negro white labor did not wish to compete with colored labor with low living standards. In fact, the wage scale was adjusted to Negro labor and was too low for whites to make a respectable living. There were few opportunities for whites to secure work in the factories of the South; besides, all labor with the hands was generally held in disrepute. Many whites undoubtedly were deterred from coming to the South because of false notions about high summer temperatures and poor health conditions. The South has never, until about 1935, striven to bring in foreigners and people from the North. It prides itself on being the purest Anglo-Saxon section of the United States and wishes to remain so. Moreover, during the many decades that these factors were checking or preventing migration to the South, there has been a stream leaving the southern states. Fully 960,000 native-born Southerners in 1860 were living beyond southern boundaries, and every decade since has shown increasing numbers.

It is difficult to say to what extent each of the above factors has influenced the population growth. The fact is, the South has not increased in population in the last 100 years as rapidly as the country at large nor, of course, as rapidly as other sections. The century's increase for the South has been six-fold; for the country at large, about eight-fold.

Conclusions as to Effect of Low Density. Throughout its entire history, therefore, the population density for the South has been that of a grazing, lumbering, and agricultural region. Normal development would have carried the South through these stages with an accompanying increase in population, as has occurred in other sections of the United States of equal area, and into the industrial; but accidents have occurred here and there in its economic development to check the growth of manufactures. Its potentialities lie dormant. Anyone acquainted with the scope and variety ing numerous sites for dams. The heavy rainfall in the highlands gives the rivers a copious flow, and the fairly even seasonal distribution of rain and forest cover at the headwaters tend toward a constant flow. The streams are particularly free from ice, except in the northern section, and the general absence of snows in the watersheds minimizes the danger from floods. The potential minimum water power of the South is estimated to be 6,320,000 hp available 90 per cent of the time. This is about 15 per cent of the potential for the United States. In 1950 the installed capacity of water power in the United States was estimated to be 18,500,000 kilowatts, and that for the South 5,962,000 kilowatts, or slightly less than one-third that for the country as a whole. In the South, particularly, there is a growing tendency towards harnessing of rivers for flood control and navigation, as well as for power. It is estimated that the hydroelectric power plants of the South today could furnish, if all of the power were used in the industries, nearly half that needed to turn all the wheels of southern factories.

In the earlier history of the United States, the building of power dams was most active on many small sites in the Northeastern States, as is shown in our study of that section. However, since the development of hydroelectric power there has been a shift to the larger streams of the country, such as the Colorado and Columbia Rivers of the West. The numerous rivers from the Southern Appalachians and Piedmont have been fairly well developed, and into this area the cotton manufacturing industry has moved since 1900. The Tennessee Valley development is more recent, and holds forth the greatest promise of all water power developments in the South.

The Tennessee Valley Authority has attracted world-wide attention, because it is a great experiment in socioeconomic planning and development. It aims not only to develop power but also to control floods, regulate run-off from large areas heretofore much eroded or subject to erosion, provide navigation, and encourage manufacturing. Today there are many dams with a total installed capacity of about 2,000,000 kilowatts (1950) and many more to come in the future (Fig. 141).

The Tennessee Valley proper includes an area of over 40,000 square miles, but the Tennessee Valley Authority operates in an area about twice that size. This organization has much that is necessary for this type of project: coal, petroleum, hydroelectric power, lumber, farm lands, metals, chemicals, fertilizer materials, abrasives, stone. Unquestionably it is proving a great aid to the upbuilding of the economy of the entire South.

Most of the great power companies now operating in the South—steam and water alike—have interconnected their power systems. Many

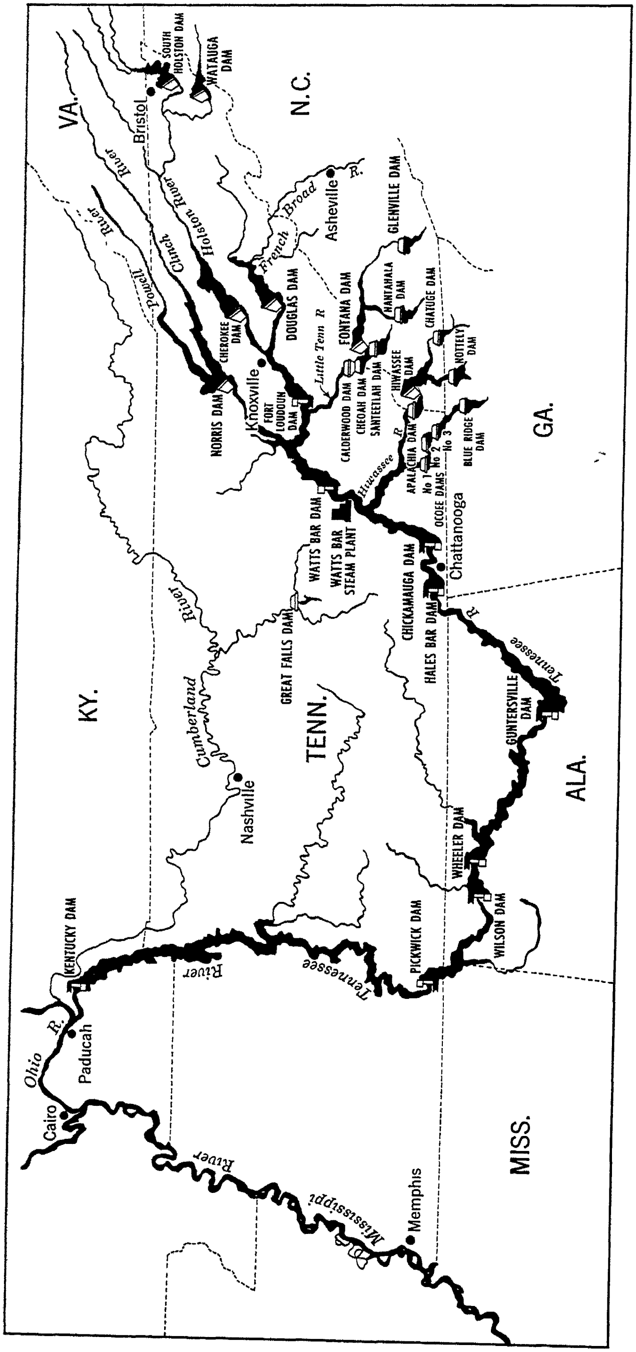

Fig. 141. The Tennessee River. Note the numerous tributaries and the locations of dams.

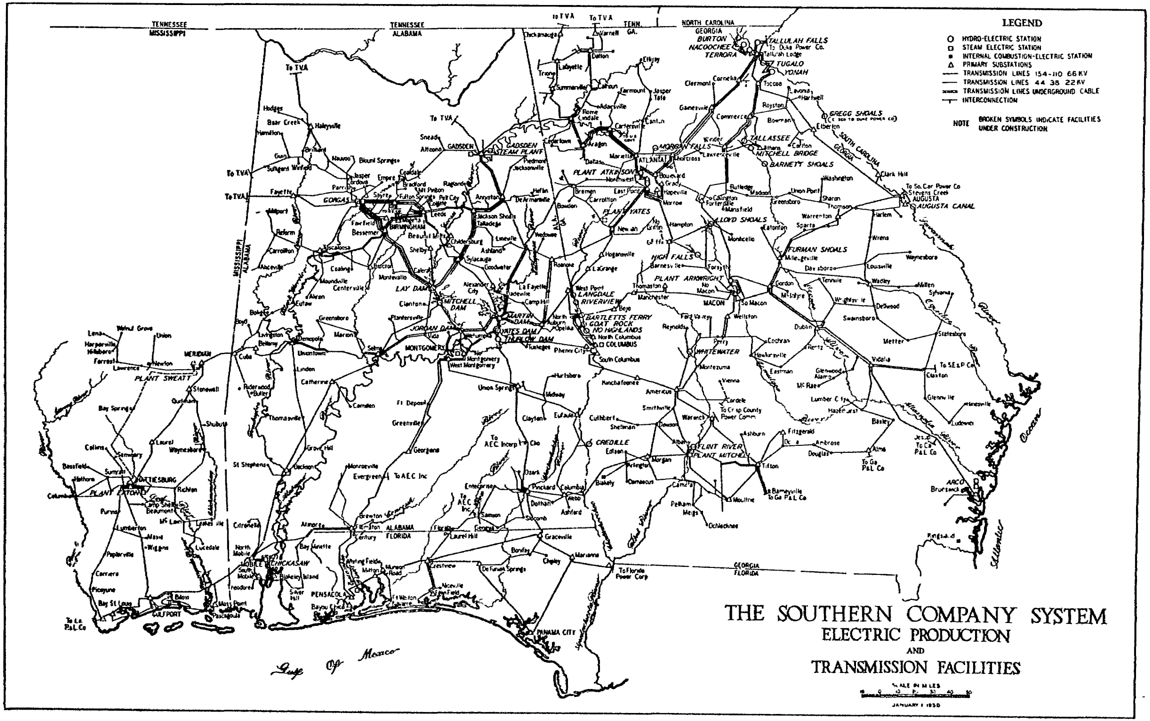

Fig. 142. Electric production and transmission lines of the Southern Company. *Courtesy, Southern Company*. Steam and water plants are frequently interconnected so that in emergencies plants may receive assistance. Water and steam power plants are likewise interconnected in the Carolinas and Virginia.

large steam-electric systems are located in or near coal fields, which may be called upon in emergencies. Thus, the power source of the South is fairly constant (Fig. 142).

A LARGE VARIETY OF RAW MATERIALS

Cotton. Of raw materials suitable for manufacture, the South has a wide variety, and of some materials it has a large quantity. Cotton is the most important of the raw materials of the South. In 1947, alone, the expenditure for new plant and equipment for textile manufacure in the South was $11,280,000, whereas that for New England was only $8,540,000 and for the Middle Atlantic States $8,700,000.

In Chapter 12 it is pointed out that the South has lands and climate to enable it to produce much more cotton than it does at present. The demand in the world market is the great factor limiting the production of this crop. Also the competition of other fibers such as rayon (discussed later) tend to lessen the demand for cotton. The latter is serious, for in no other field is the rivalry between man-made and natural materials felt more keenly than in the fibers. Rayon is the major contender among several others recently produced. In 1951 there were 1,294,000,000 pounds of rayon produced in the United States, which was estimated to be the equivalent of 2,800,000 bales of cotton, or about one-fifth of the cotton crop.

Other Farm Products. Among the other agricultural products are cottonseed, corn, the tung nut, and peanuts, all yielding vegetable oils that are increasing in demand year by year. Cottonseed will increase only as cotton production increases; but the areas given to the three other oil-producing products may be greatly extended. Fruit and vegetables for canning and preserving find congenial climatic conditions in the South. At present, production is limited chiefly by the demands of the early northern markets. A greater number of canneries would reduce the hazard of late seasons and glutted markets, and benefit the producers greatly.

The Timber Resources. The timber resources of the South have long been the basis of an extensive sawmill industry and of a less important woodworking industry. Nearly every portion of the South, except the semiarid parts of Oklahoma and Texas, was once covered with dense forests. The Southern or yellow pine, of which the longleaf pine is the most prominent variety, was confined for the most part to the Coastal Plain. Over the remainder of the forest area there were hardwoods. Most of the hardwoods and some of the pines on the lower lands have been removed to make way for agriculture. The pines for two centuries have dominated the lumber industry, the hardwoods becoming of importance only since about 1900.

Although the slaughter of the forests has been great—the southern states furnishing 42 per cent of the lumber cut in the United States—there are still great stretches of hardwood in the Appalachian Highlands and of pines in Mississippi, Florida, Alabama, Louisiana, and Texas. These will be rapidly removed if the present rate of cutting continues. The adoption of and adherence to a sane forestry policy, utilizing all the essential areas at the headwaters of streams along which there are water-power plants, and growing trees on the rough, hilly, stony areas and areas that are unprofitable as agricultural land, would enable the South to grow sufficient timber to meet its needs for a long time, if not for all time to come. There are tens of thousands of square miles of cut-over land on the Coastal Plain, now idle or supporting a few cattle to the square mile, that should be growing timber. All that need be done to put much of this land to the production of forests is to modify the tax laws in favor of forest lands. Nowhere in the United States do forest trees grow so rapidly. Reliable authority states that commercial pine timber may be grown in 30 years, and pulpwood in considerably less than that time. The timber crop, which is the basis of many industries, can be made as constant a product as corn or cotton. Had good forestry practices been followed since timber cutting began in the South, a dozen or more crops could have been produced.

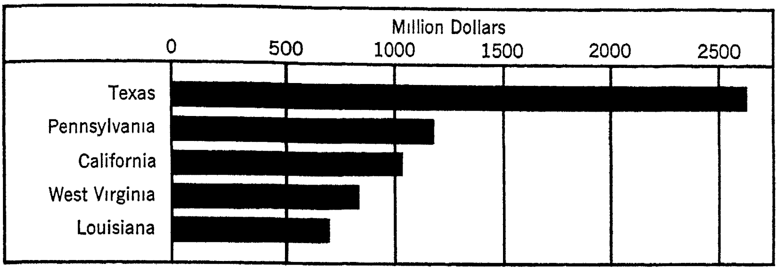

Fig. 143. The value of mineral production in the five leading states in the United States in 1950.

The Mineral Resources. The rocks of every geologic period are represented in the southern states. There are old igneous, metamorphic, young igneous, old sedimentary, and recent sedimentary. It is not surprising, therefore, that the variety of minerals of economic importance is great. Of a few—and happily they are among the more useful—the South has great stores, in fact, holds front rank (Fig. 143).

Iron Ores. Iron ore is widely distributed and, in general, excellent in quality. A recent estimate gives the South about 46 per cent of the 3,726,000,000 long tons that are "measured and indicated" to be the reserves of iron ore in the United States.[3] In 1950 there were mined 7,507,000 long tons of iron ore in the South. This means that, even with great increases in mining, there will be iron ores in the South for a long time to come. During the period of high prices and active demand ten or more of the Southern States mined and shipped iron ore. The chief deposits are located in the Great Appalachian Valley, occurring here and there from western Virginia to central Alabama.

At only a few places in the Great Appalachian Valley are the ore deposits being mined. There is thus great opportunity for further expansion in the number of blast furnaces and the iron industry in general, for good coking coal and limestone exist within a few miles of nearly every deposit. Thus geographic conditions favor the production of iron in the South as cheaply, if not more cheaply, than in any section of the country.

Copper. Copper does not occur in relatively large quantities, nor do the deposits compare with those of Utah, Arizona, Nevada, New Mexico, Montana, and Michigan in richness of ore and production and reserves. There is probably little chance for greater expansion in this field. The one large plant in the South is at Ducktown, to the east of Chattanooga. The ore mined is a sulfide, and in 1898 a large addition was made to the plant to manufacture sulfuric acid as a by-product. The mines were opened in 1842, and it was from them the Confederate States obtained all their copper during the Civil War.

Bauxite. Of bauxite, the ore from which aluminum or aluminum salts and artificial corundum are obtained, the South has a monopoly. However, the production in the United States is only about half the total amount consumed. Imports come largely from Surinam and British Guiana. Arkansas bauxite dominates the aluminum industry to the extent of furnishing more than 90 per cent of all the bauxite produced in the United States. Tennessee, Alabama, and Georgia also have deposits. The South, therefore, is intimately interested in any expansion that may take place in this industry in the future.

Sulfur. Since 1906 the South has come to hold a leading position in sulfur production in the United States, and even in the world, for about 80 per cent of the sulfur consumed in the United States and 75 per cent of that of the world comes from Texas. In these states the sulfur occurs in huge domes 100 feet or more thick, and 3 or more miles across. The Fresch process, which employs superheated water to melt the sulfur in the ground and air pressure to force the melted sulfur to the surface, greatly reduces the production cost of this useful mineral. Sulfur is produced at so low a cost in the Gulf area that only by agreement between Italy and the American companies are prices maintained sufficiently high to permit the mines of Sicily to operate. In 1920 Louisiana and Texas produced more than 1,500,000 tons; and Texas alone, in 1950, about 4,000,000 tons. The sulfur deposits of Louisiana have been worked since 1940, producing approximately 1,000,000 tons in 1950. Before 1906, Sicily furnished the world with sulfur. The demand for sulfur is increasing year by year in many industries because of the great use of sulfuric acid in many chemical processes. The immense quantities and the low cost of production make it certain that the South will maintain its dominance in this mineral for many decades to come.

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[3] "Investigation of National Resources," hearings before a committee. U. S. Senate, May 1947.

Phosphate Rock and Clays. The State of Florida alone produces about 75 per cent of the phosphate rock in the United States, and about 47 per cent of the total of the world. The importance of this resource in agriculture can hardly be estimated, because it is an element of soil fertility, readily depleted by repeated cropping. Idaho, Montana, Utah, and Wyoming have tremendous reserves of this rock, but they are far from the markets. The demand will certainly increase as our soils become more depleted of their phosphorus content and intensified farming increases.

Raw materials for the clay industry, in all its phases from common brick to porcelain, are widely distributed, and so also are the ingredients for cement.

Other Minerals. Among the other minerals which are produced in large quantities in the southern states, for which there is a call in the industries, are zinc, asbestos, mica, graphite, feldspar, limestone, gypsum, lead, and salt.

OTHER FACTORS AFFECTING THE GROWTH OF INDUSTRY

Other factors influencing the localization of factories are capital, labor, and markets. Capital is mobile. It tends to flow to the region that promises the largest return and the greatest security. For a century or more, the greatest movement in the United States has been westward. Some capital has come south; but for the most part the South has been overlooked. There are many reasons for this condition; slavery, the Civil War, and others. The South has never advertised like the West. With active and honest advertising of the advantages to be found in the South by manufacturers, the inflow of capital from the great financial centers should be far greater than it has been in the past.

The low population density and the consequent scarcity of manufacturing population in the South have previously been discussed. Whether or not the South will be checked in its industrial development by the low population density will depend upon the rate at which new factories are introduced. Even without immigration, the rate at which industries are now being introduced will need to be increased materially to utilize the labor that the normal population increase will provide. Inasmuch as the rural population of the South exceeds the urban, most of the laborers demanded for the new factories will come from the farms, and the increasing use of farm machinery tends to release labor for the factories.

The South does not possess the proportion of skilled labor that the older manufacturing sections of the country do. This condition, though of some importance, is not so serious as formerly when hand labor was more prevalent in industry. Automatic machinery, moreover, is greatly reducing the number of skilled laborers needed in any factory. The initiative and proverbial inherent ingenuity of the people of the United States—and most of the laborers of the South are native-born—enables any plant to develop skilled workmen within a short while. The experience of superintendents in cotton mills, furniture factories, and machine shops, in dealing with raw industrial help, shows what may be done even by unskilled workmen. Operators and foremen who are acquainted with labor and labor conditions, in both northern and southern factories, point out many favorable characteristics in southern laborers. In most trades and in most parts of the South, labor is cheaper than in other sections of the country. Some wage scales are dominated by the presence of Negro labor, but this is not the basic cause of low wages. Many of the laborers are fresh from the farms and unaccustomed to large labor returns. Living expenses of laborers are generally low in the South, for coal bills, housing costs, and clothing bills are influenced by the genial climate of the southern latitudes. Laborers accustomed to farm life are more economical in their living than those accustomed to urban life. They are unionized only with difficulty and are not easily led by labor leaders. How long the manufacturers will be able to take advantage of these favorable conditions, and how long these characteristics will persist as factors in enticing manufacturers to the South, is problematic.

The problem of markets, their accessibility and absorbing power, is also of prime importance in the localization of industries. Inasmuch as the South is now producing, and will in the future produce, commodities similar for the most part to those of the factories of the North, it can hardly hope to send much of its goods northward. Its hope lies, first of all, in developing its own local markets and thus replacing northern-made goods. This it should do since it can in most industries manufacture products more cheaply than northern factories, and has the advantage of short haul. Its own markets are of no mean proportion, for here are more than 30 per cent of the people of the United States, and the purchasing power of these people is great. In the contest with the North or Europe for foreign markets, the South again has the natural advantage in position when markets are sought on the American mediterranean and nearly all countries bordering the Pacific. The Panama Canal gives the South a decided advantage in obtaining the trade of the west coast countries of South America and the Pacific possessions of the United States. New Orleans is 450 miles nearer Valpariso, Chile, than New York is, and more than 1000 miles nearer than Liverpool is. New Orleans is 500 miles nearer Puget Sound by way of the Panama Canal than New York is. If proper port facilities and ocean traffic lines are provided, the geographic position of the South will be of particular advantage to its manufacturers seeking markets in these regions. Every important port in the South today, on the Gulf and the Atlantic, is active in providing wharves, railroad terminal facilities, and warehouses, and is enlarging its shipping. New Orleans has developed and enlarged its port facilities, including a

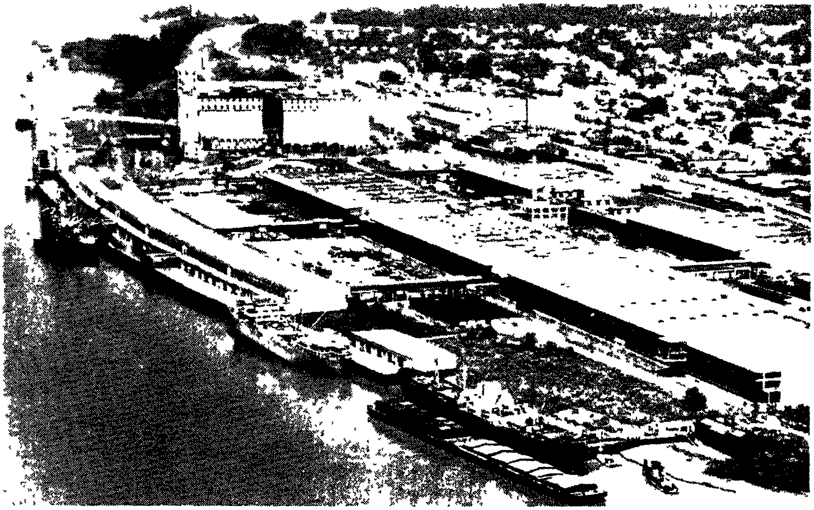

Fig. 144. Grain elevator and warehouses at the Port of New Orleans. *Courtesy, New Orleans Chamber of Commerce.* Warehouses cover many acres of this port, some of which have been set aside as a "Free Port" area, not subject to customs duties and regulations. Much cotton is stored and shipped, as well as cane sugar, wheat, lumber, and farm machinery.

"free trade" zone with large docks and warehouses in which many millions of dollars are invested (Fig. 144).

In Southern port development there is much rivalry in organizing traffic routes, securing particularly favorable railroad rates with interior points, and providing the best port facilities. At Memphis, Tennessee, a river port, the city is justly proud of the two railway bridges and a new highway bridge over the Mississippi River (Fig. 145). Houston, Texas has perhaps led all other cities in its efforts to improve its position. After many years of work and great expense, a 50-mile-long ship channel has been dug, connecting Houston with the Gulf and making of it a Gulf port. It has a well-arranged turning basin for ships, and many industries have been attracted to the place, for it taps an area of great production in petroleum, cotton, and wheat. In 1950 Houston's population reached 594,000, and it thus replaces New Orleans as the largest city of the South (Fig. 146).

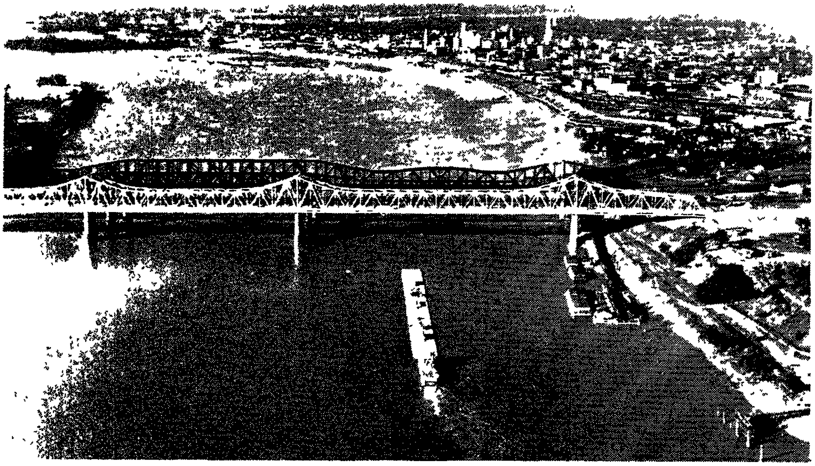

Fig. 145. The Mississippi River at Memphis, Tennessee. *Photo by Paul A. Moore, Tennesee Conservation Department.* The picture shows barges on the river and bridges across the river. This port has large municipal river and rail terminals, and thus has all-water connections with the ports of the world. In the foreground is the new Memphis and Arkansas Bridge, a four-lane, toll-free highway bridge. The other two bridges (one indistinct in this picture) are for the use of railroads exclusively

Of considerable importance to the South is the Intracoastal Waterway, which was originally planned to connect New York with Brownsville, Texas, as a continuous waterway, making use of lagoons behind sand bars, and sometimes cutting through the Coastal Plain. It is complete

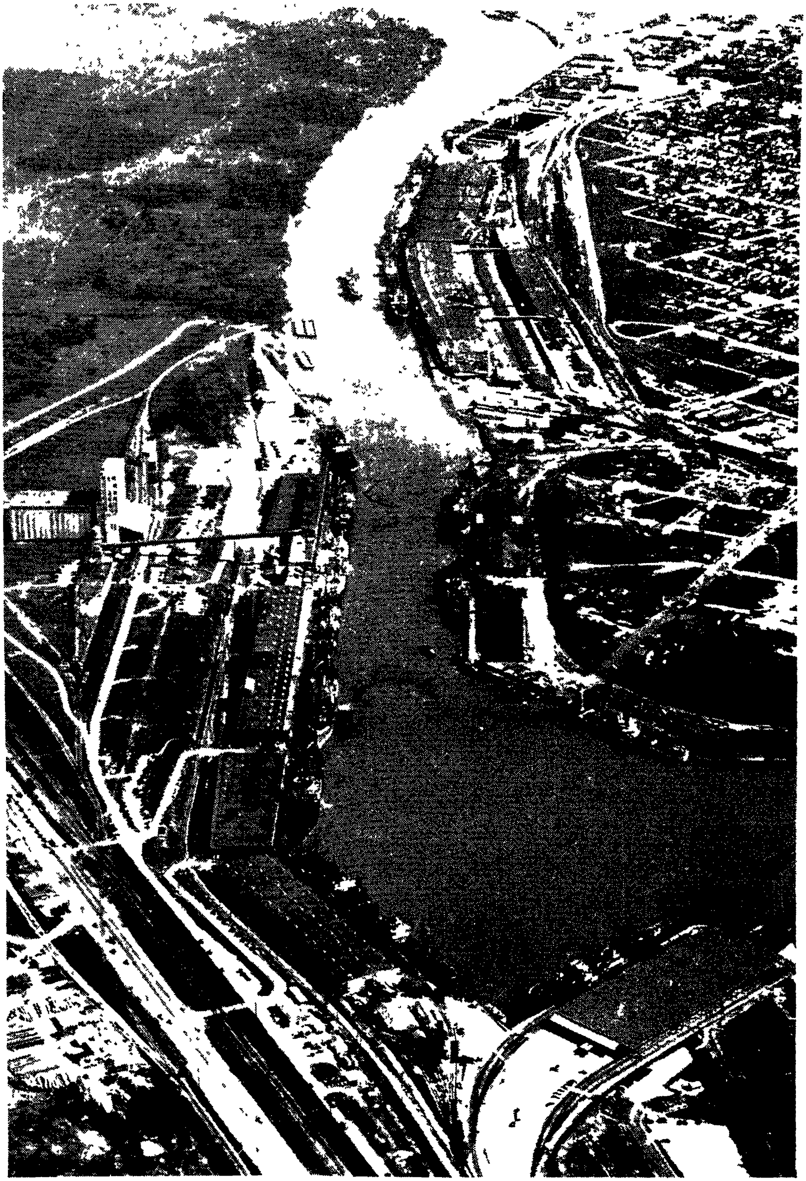

Fig. 146. The turning basin and ship channel at Houston, Texas. This 34-foot-deep channel, 50 miles long, is an example of how man has made a port out of an inland city. Houston boasts of being the second port of the nation in tonnage handled annually. Along this channel are located 38 chemical plants, producing 100 different industrial organic and inorganic chemicals. It is predicted that Houston will some day be the world's leading chemical port.

except across northern Florida, but an extension reaches Key West. On the Gulf Coast it is complete from Florida to Corpus Christi. Its importance along the South Atlantic Coast is that it offers a relatively safe route for pleasure craft reaching the Florida resorts. From Mobile and westward along the coast it links with the Mississippi system. Considerable heavy barge traffic reaches Galveston, and some as far beyond as the sulfur mines at Freeport, and even to Corpus Christi. As industries develop along the Gulf and South Atlantic Coasts, this waterway should be of greater importance (Fig. 147).

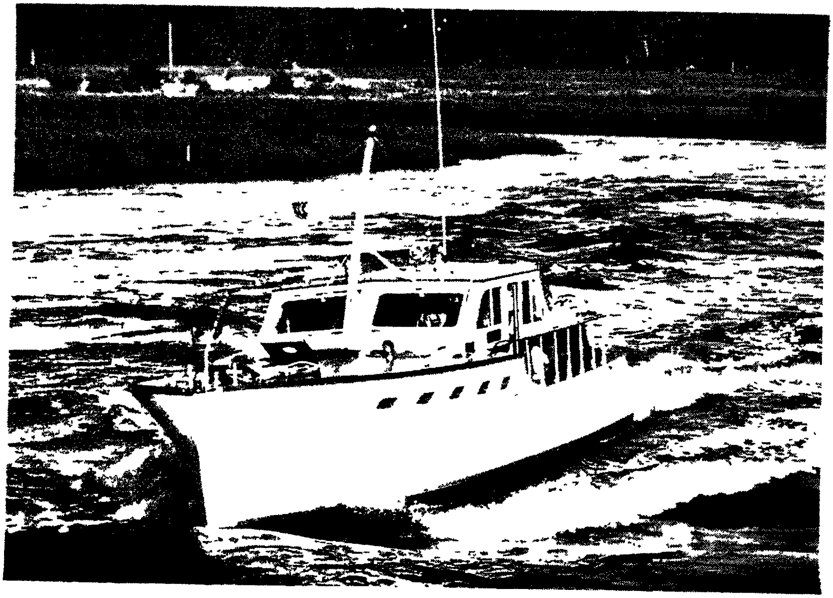

Fig. 147. Scene along the Intracoastal Waterway near Jacksonville, Florida *Florida State News Bureau.*

THE MAJOR INDUSTRIES

Iron and Steel

The Beginning of the Industry. One of the earliest industries established in the Jamestown settlement was the manufacture of iron. During the first half of the eighteenth century several furnaces and forges were built in Virginia near the Potomac River and the Chesapeake Bay, where "hollow ware" was cast and sold throughout the colonies to the south.

Some of the pig iron was sent to England, and even to Massachusetts and Rhode Island, for further manufacture.

At many of the settlements later established beyond the Blue Ridge, there were small forges and furnaces, making iron implements and utensils that could be brought from the Eastern foundries only with great difficulty and at considerable cost.

In 1810 the South was producing about 18 per cent of the pig iron of the country. Virginia stood second among the states of the Union, and Maryland fourth. By 1840, 26 per cent of the country's iron was made in the South; but about this time there began a rapid concentration of the iron industry nearer the anthracite coal fields in the Scranton and Wilkes-Barre region and anthracite replaced charcoal as a fuel in Pennsylvania. Then began the rapid rise of the iron industry in the North.

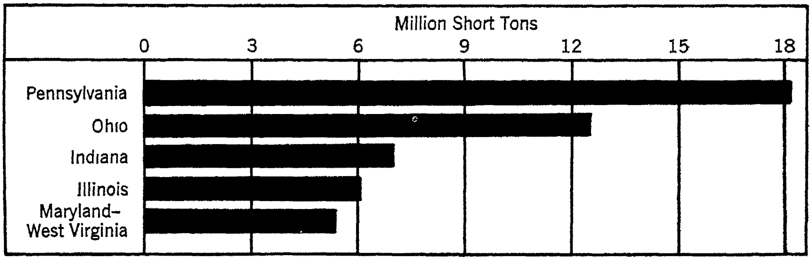

Fig. 148. The production of pig iron in the five leading states of the United States in 1950.

During the Civil War the iron industry necessarily increased greatly in the South, because it had no competition and was called upon for emergency production. Furnaces were built in most of the iron ore districts. The west central Tennessee furnaces, after the Union invasion of Tennessee, were closed; but those of central and northern Alabama, northwest Georgia, and southeast Virginia continued in operation until near the close of the war. However, many of these ceased operation or curtailed their output during Reconstruction times. It is estimated that not over 5 per cent of the output of pig iron of the United States was made in the South at the close of the war. Since 1880 the production of the Southern States has ranged from approximately 8 to 20 per cent of that of the country. In 1950 the output was about one-sixth that of the country, and almost one-half that of Pennsylvania (Fig. 148).

The Rise of Birmingham. In the decade between 1880 and 1890 the Birmingham region began its rise, but this decade also saw the opening of the rich iron ore deposits west of Lake Superior and their cheap transportation to the Pittsburgh region; so it is not surprising that the growth of the industry in the country as a whole was greater than that in the South.

The modern iron industry of the South really began in 1867 with the building of the Rockwood furnaces at Rockwood, Tennessee, by ex-Union army officials who were attracted to the area by the admirable natural conditions offered for the production of pig iron. The modern industry in Alabama dates from 1876 when a coke oven was opened at Oxmoor. Three years later the first coke oven at Birmingham was completed, the rich hematite displaced the limonite which had been the ore mostly used in the forges and small furnaces, and coke displaced charcoal.

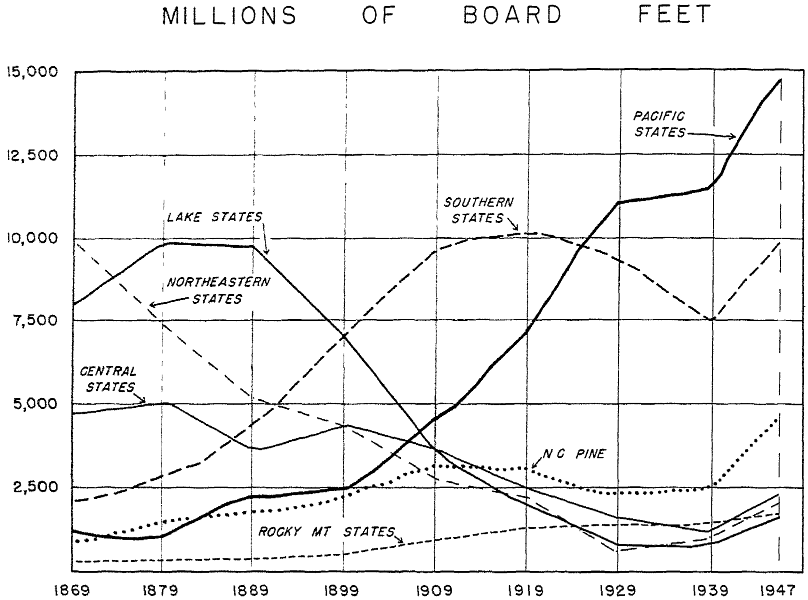

Fig. 149. The rise and decline of lumbering in the various forest regions of the United States. Interpret these curves. Write the history of lumbering in each of the regions. Lumbermen have often migrated from one region to another. How do these curves show the direction of migration?

Distribution of Furnaces. By far the largest number of active furnaces in the South today are located in the Great Appalachian Valley. Alabama and Tennessee contain most of them. The outlook for the industry in the South is bright so far as environmental conditions are concerned, for ore, fuel, and limestone are in proximity. Man is largely the determining factor of the industry. He may take advantage of these favorable environmental conditions and avail himself of the opportunities offered. The increasing use of agricultural implements on southern farms, the active construction of large business and public buildings requiring steel structures, the improvement of railroads, the extension of the underground pipe lines of various sorts, and the expansion of the foreign trade all call for a great amount of iron and steel. During World War II the development of a large steel industry at Sparrows Point, Maryland, shows the importance of cheap water transport. Birmingham steel rails and other iron commodities are finding their way into the great Asiatic markets as well as to the Pacific Coast of the United States and Latin America. But the industry will concentrate at Birmingham as it is now doing. Undoubtedly, the Tennessee Valley Authority is a great influence in bringing an industrial development to this part of the South.

The Forest and Woodworking Industries

Forest Industry One of Long Standing. The history of the lumber industry in the South does not stir one who is interested in the welfare of these states with the spirit of exultation, like the story of cotton. The story of the lumber industry is a recital of three centuries of wanton waste and destruction, with no attempt until about 1930 to reduce the waste and to compensate, by reforesting, for the destruction and devastation. For 300 years the forests have been a revenue-producing resource, a resource whose value has ever been increasing. For 250 years the forests were largely believed to be an obstruction to agriculture. It is only since about 1900 that they have become one of the leading sources of commercial timber for the country. It is estimated that four-fifths of the original yellow pine stand has been cut since 1870. For some 10 or 12 years before the Civil War, the southern states were producing about 15 per cent of the lumber cut of the United States. During and following the Civil War, the cut in the South declined and did not reach its prewar importance until about 1885. Most of the lumber consumed in the country until

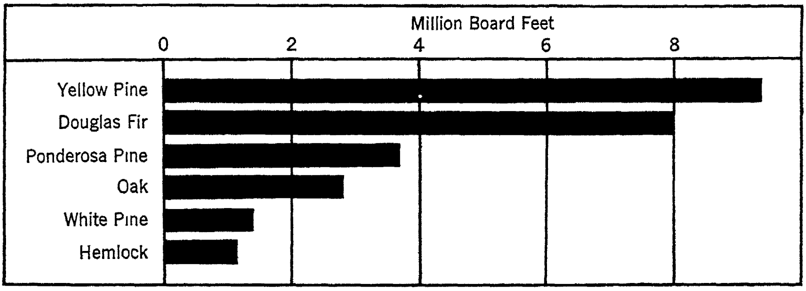

Fig. 150. Lumber production in the United States by species. Average 1940–1949 inclusive.

about 1850 came from the Northeastern States. By that date the Great Lakes Region was just at the beginning of its spectacular rise; it reached its highest point of production in 1885, and by 1890 was on the decline. The Northeastern States had been declining for half a century. From 1899 to 1930 the South was the leading lumber-producing region in the country (Fig. 149). It now holds second rank, the Pacific lumber region being first. Since about 1930 the Southern yellow pine has been the chief lumber-producing tree in the United States (Fig. 150). Most lumber yards in the United States east of the Mississippi River carry southern-grown and -sawed lumber. Southern hardwoods, which are shipped chiefly from Nashville and Memphis, are used in furniture factories, implement and wagon works, planing mills, etc., as far west as the Rocky Mountains (Fig. 151).

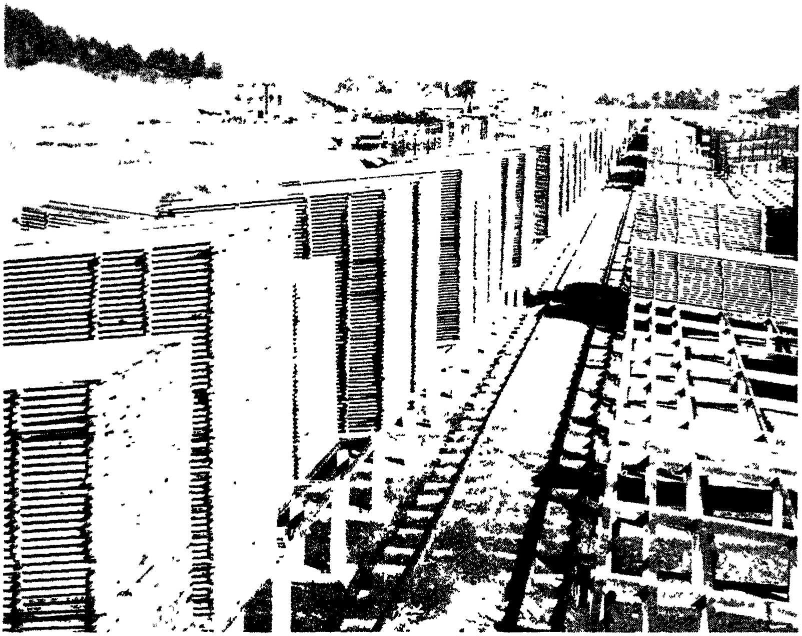

Fig. 151. Sawmill and lumber yard near Greenville, South Carolina. *Courtesy, South Carolina State Forestry.* The Southern Appalachians are productive of lumber and several sorts of wood for the paper mills. In this photograph, notice carefully how the lumber is stacked. Relate what you see to the fact that this portion of South Carolina has an average annual precipitation of about 50 inches.

Southern forests including cut-over areas now take on an increased importance because of technical advances which permit the making of pulp, and the rayon and plastics industries which use considerable wood. For many years the high resinous content of southern pine prohibited its use as pulp, but it was discovered that only the older trees, more than 25 years old, have resin. The southern forests have been cut so thoroughly that now most of the forests contain growths that are less than 25 years of age, and regrowth is rapid. The South promises to become the great future source of pulp for various uses.

Since about 1930 the waste in the lumber industry has been greatly reduced. Some of the larger lumber plants of the South have paper mills and turpentine and chemical distilling plants in proximity to the sawmills and planing mills, so that limbs, stumps, and low-grade timber are no longer burned or left to rot but are manufactured into valuable by-products.

Naval-Stores Industry. Naval stores, paper and pulp, and articles of wood are largely products of secondary forest industries. The naval-stores industry has existed since colonial days. About 1700 the British Government offered a bounty for the production of naval stores. The center of the industry has migrated southward. It is largely centered at present in western Florida and southern Georgia. Savannah is still the chief export port for naval stores. The general use of the cup, introduced in some parts about 1904, has greatly reduced the damage to trees and prolonged the life of the industry. Today there is much turpentining in connection with the lumber industry. The trees are tapped and bled for 2 or 3 years before being cut for lumber. The refuse of many mills is used for paper (Fig. 152).

Paper and Pulp Industry. The paper and pulp industry is new to the South. In 1909 Virginia produced only 1.4 per cent, in value, of the paper and pulp of the United States, and West Virginia 1 per cent. From 1909 to 1947 the output of the industry in Virginia increased from 48,600 tons to 630,000 tons, and there were also mills in Louisiana, Maryland, West Virginia, Tennessee, North Carolina, Delaware, and Texas. The forests of the Appalachian Highlands are the chief source of the woods used in the sulfite process. A process has been perfected for producing high-grade kraft paper from Southern pine at a cost about as low as from other woods; and Dr. Herty has demonstrated that a white newspaper may be produced from the sap wood of slash pine, which is stronger and lighter in weight than newspaper stock from Canadian spruce. This is greatly stimulating the pulp industry of the South and it is assuming greater importance every year. The decline of imported pulp from Scandinavia due to the war, and the increased use of paper cartons for packing has stimulated the industry in the South. The increase in paper pulp from southern mills from 1930 to 1940 was 187 per cent, showing a greater advance in the industry than in any other section of the country

There is a great future for the industry in the Southern States, for the northern forests are about depleted and pulpwood may be grown rapidly in the South. The present high price of paper has made possible the use of cotton lint as a raw product for the manufacture of a beautiful, pure, high-grade paper. Today there are several score of kraft paper and pulp mills in the deep South, and much newsprint is coming from that section. Large mills are located at Orange and Lufkin, Texas, and at Savannah, Tennessee, and Rome, Georgia, as well as numerous other places. Considering the natural advantages for production, the South is destined to dominate the paper and pulp industry in the future.

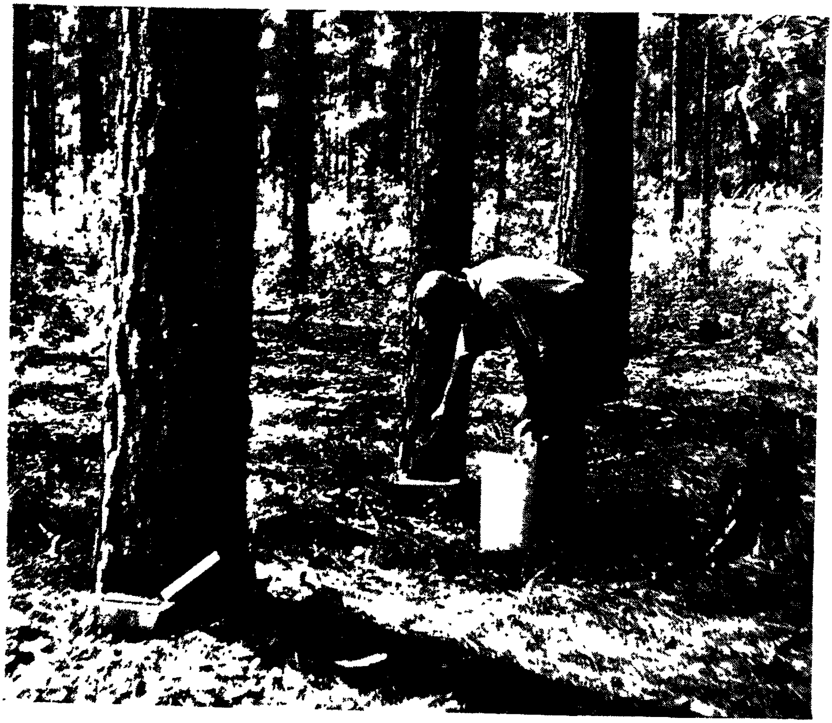

Fig. 152. "Dipping." *Courtesy of North Carolina Department of Conservation and Development.* Gathering crude gum on a naval stores experimental plot on the North Carolina Department of Conservation and Development's Division of Forestry, Bladen Lakes State Forest.

Tanning. In many parts of the South, particularly those near or within the Appalachian Highlands, there has been in the past a considerable industry in tanneries, and tannin extract plants, using oak bark, chestnut bark, and wood. The ravages of the chestnut blight which kills the trees, the depletion of oak forests, together with improved chemical processes applied to the tanning of leather, has caused a decline in these industries.

The Furniture Industry. In the furniture industry, the South is making a beginning in the complete manufacture of its forest products. In 1950 more than one-third of the net value of the manufacture of wooden furniture, not upholstered, in the United States, came from the South. The South Atlantic States, alone, produced more than $250,000,000 worth.

The presence of hardwood in the Central Western States first localized the furniture industry in Grand Rapids, Evansville, and other cities; and the momentum of establishment has carried it on to its high rank in these states. The South has every advantage that these states originally had. It now has the greater bulk of the hardwood of the country and is nearer the cabinet-wood supply of tropical America than the northern furniture centers. Time will give the southern workmen skill and artistry, and their goods will win markets. Already much of the southern-made furniture is sold in northern salesrooms, and it should soon dominate all southern furniture markets. The central Piedmont leads in the furniture industry of the South. High Point, North Carolina, is to the South what Grand Rapids is to the North. Martinsville and Bassett, Virginia, are other leading centers. Bedroom and dining-room furniture is quite a specialty, but in general the southern industries turn out a medium-grade furniture to meet the large market of the middle classes.

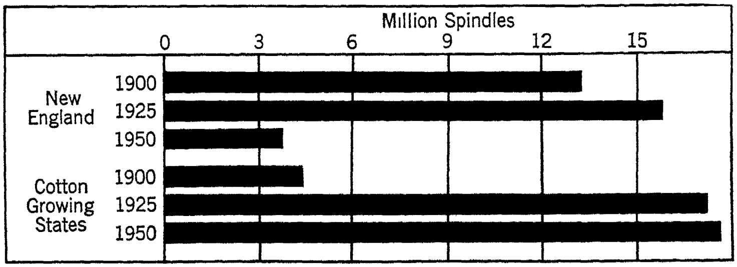

Fig. 153. Change in location of cotton spindles in the United States since 1900. (New York State has quite recently increased its number of cotton spindles in place, but elsewhere there are few cotton spindles.)

Textile Manufactures

Cotton Manufacturing Migrates Southward. The most rapidly growing industry in the South today is textile manufacturing. From 561,000 active spindles in 1880 to 18,545,000 spindles in 1951 is the growth that has taken place. This growth has been most rapid in Virginia, North Carolina, South Carolina, Georgia and Alabama—the southern Piedmont. New England was for a long while the leading section of the country in textile manufacturing, but the South had about equaled New England in numbers of spindles by 1920, and in 1951 it had over 90 per cent of the active cotton spindles in the country and about one-tenth of the number in the world. The industry has been dominated by cotton (Figs. 153 and 154).

There has been little expansion in New England industries since 1930. Most of the water-power sites in southern New England have been utilized. Many mills were equipped with machinery which was antiquated yet too good to be scrapped. Labor unions, adverse legislation, and other factors are restraining the textile industry from further expansion in New England. It is more economical to operate in the Southern States where there is plenty of clear water in streams, cheap hydroelectric power, cheap land, low taxes, raw products close at hand, and an adequate supply of English-speaking labor, intelligent and quick to learn. All these conditions are found in the Piedmont extending from Virginia through the Carolinas into Georgia. In general, cotton manufacturing centers about Charlotte, North Carolina.

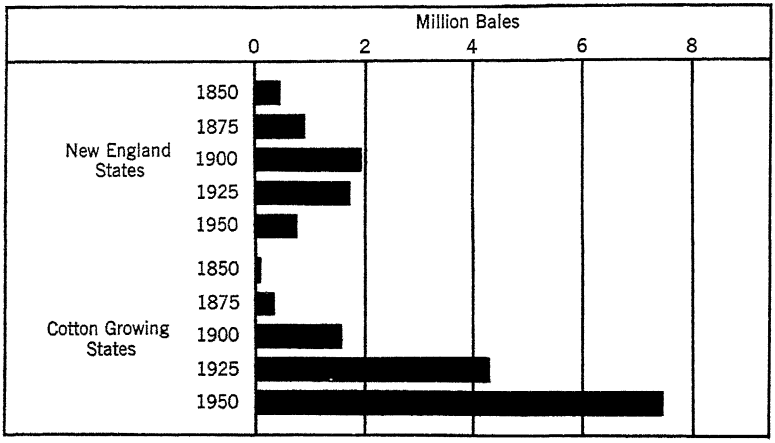

Fig. 154. Domestic cotton consumption by New England and southern mills since 1850.

Some Comparisons. Southern mill towns, in the main, have a wholesome environment. Lower wages and longer hours have prevailed in the South, but this latter condition is rapidly passing, for the influence of labor unions has increased. The belief that the output of labor could not equal that of the North, and that the southern mills could not turn out as fine a grade of cloth as in the North, has been dispelled.

The growing seasons are longer in the South, and winters are not so severe as in the North. Population is sparse, and factory workers may have open spaces for living, where vegetables may be grown, and costs of keeping a household kept relatively low. This lower cost of living in the South has tended to offset the higher wages in the North.

Rayon. The development of the textile industry in the South has been on the basis of cotton as the fiber, but any discussion of the shift of textile manufacturing must account for the important rise of the rayon industry, particularly since World War I. Rayon is a product of the chemical laboratory, in which plant cellulose is obtained, treated, and by a complicated technical process turned out as fiber resembling natural fibers. It may seem strange that this fiber has entered competition with cotton, when the South has tremendous possibilities of cotton production. Worldwide unstable economic conditions, the boll weevil, competition with other cotton-producing countries, and the advance in technology in industry all enter as factors in explaining the rise of rayon. Also remarkable is the fact that cellulose is obtained largely from wood and from cotton linters;[4] both of which the South supplies, and the same factors that enter the localizing of cotton manufacturing applies to rayon, for sometimes the fibers are mixed. Much of the rayon manufacturing is controlled by large corporations. Of the 26 large rayon plants in the United States in 1949 the state of Virginia had 7; Tennessee had 5; Pennsylvania 3; West Virginia, Georgia, and Ohio had 2 each; North Carolina, Alabama, Maryland, South Carolina and New York each had 1. The South contains the major portion of the rayon industry. Rayon can be made inexpensively, and it promises to continue in strong competition with cotton.

Nylon. A second fiber that has come to play an important part in the textile industry is nylon. This fiber is one among many that have been developed by the du Pont and other research chemists, and it is truly a synthetic fiber, first made up into a raw material which the chemists call "amide salt." It is prepared either from coal, as in the du Pont ammonia plant at Belle, West Virginia, or from gaseous hydrocarbons as by-products in petroleum refining, for which there is a large plant at Orange, Texas. In the vicinity of this city is produced more "nylon salt" than any other place on earth. Other plants are located in Virginia and Tennessee. There is a tendency for this industry to locate in the South in proximity to coal, petroleum, and natural gas.

[4] Linters consist of the remaining cotton fibers which cling to the seed in the ginning process.

After the production of amide salt, there remains still the technical process of producing the filament. It can be fine, resembling silk, or coarse for such use as brush fibers; transparent sheets may be prepared for various purposes, and it may be used as a plastic. This material first entered commercial production in 1939; by 1951 the output was more than 60,000,000 pounds, and hosiery mills were using it extensively. Coming at a time when the Japanese silk industry was practically destroyed, in order to turn industries to war materials, nylon production in the United States thrived. It can be made so inexpensively that there is little likelihood that the silk industry will revive, for nylon may be used for nearly all the purposes for which silk was used.

Beyond rayon and nylon there is also great promise held for the future fiber manufacture from synthetic resins, proteins, and glass. Some of the basic materials that enter are the soybean, peanut, cottonseed, and chemicals, which the South could produce in great quantities.

Industries Related to Petroleum and Natural Gas

Petroleum. Petroleum of the Oklahoma, Texas, and Gulf Coast fields was formerly transported by boat, tank car, and pipe line to the north central and northeastern states where it was refined. Considerable of this continues, but with the stimulus of World War II there has been a rapid growth of petroleum refining in the oil fields, particularly along the Gulf Coast and in cities not far inland. Large refineries are located at Dallas, Fort Worth, Waco, Beaumont, Port Arthur, Corpus Christi, Baton Rouge, and other places. East Texas leads the world in petroleum refining. The war-created demand for aviation gasoline has brought great changes in the refining industry because it has resulted in several new product industries that are associated therewith. These are found all along the Gulf Coast. Among such are toluene plants for the manufacture of a basic material for trinitrotoluene (TNT), butadiene plants for the manufacture of synthetic rubber, and many others.

Natural Gas. Much attention is now being given to natural gas. Since gas is closely associated with petroleum, often issuing from petroleum wells, much was wasted in the early days of the industry. Often it was fired and let burn so as to have it out of the way. Now such gas is controlled in its flow, and put to use. Gas pipe lines, like oil lines, are now extended long distances to the north and northeast, and gas is put to use, largely for fuel in household and industry. This has become a large business. Also in the oil fields and along the Gulf Coast there are now recycling plants that "strip" natural gas of gasoline, butane, and other minerals. Carbon black is made from natural gas; Texas and the Gulf

Coast produces more than three-fourths of the United States supply. This product is an indispensable ingredient in the manufacture of rubber tires, without which our economy could not function in either peace or war. All these products are basic materials in industry, which when coupled with salt, sulfur, bauxite, and other raw materials serve to attract many industries to locations in the South. The Dow Chemical Company is located at Freeport, Texas, making metallic magnesium from Gulf waters; alumina is made from bauxite at Mobile, Alabama; Houston has a steel industry using natural gas and iron and steel scrap metals; Corpus Christi has a zinc smelter and an alkali plant; Texas City has tin smelting; basic materials for rayon manufacture are turned out at Orange, Texas; paper and pulp mills are located throughout the South; many others could be named.

During and since World War II much of the heavy chemical industry and shipbuilding has been attracted to the Gulf Coast. The entire south Atlantic and Gulf Coasts of the South are gradually growing in importance as trade with Latin America increases, but the development on the Gulf Coast industries has been phenomenal since 1940, and it holds great promise for the future.

Tobacco Manufacturing

Wherever tobacco is grown the industry that turns out the finished product is likely to be carried on, in a large way. The Kentucky "burley" tobacco is made into cigars mainly at Louisville, and into cigarettes only in that town. The industry is found in many towns in Tennessee, Georgia, South Carolina, and Florida, but the industry is largely centered in the "bright tobacco" region of Virginia and North Carolina. Since World War I cigarette smoking has increased tremendously, so that today a much greater proportion of the tobacco crop goes into cigarettes and consequently less into plug tobacco, cigars, snuff, and other uses, than was formerly so. The thin soils of Virginia and North Carolina are well adapted to "bright tobacco" culture, and here many people have studied and solved the intricate problems of growing and manufacturing the product. Durham, North Carolina, was built around a tobacco factory. Greensboro is a leading cigar manufacturing center, and Winston-Salem alone produces about two-thirds of the nation's cigarettes. Tampa, Florida, ranks high in the manufacture of "Havana" hand-wrapped cigars.

OUTLOOK

Undoubtedly the saying "Cotton is King" in the South is being seriously disputed. The Civil War, boll weevil, diversification of crops, wars, machinery, and technology have brought about great changes. The physical fact of facing the South Atlantic and Gulf is of increasing importance. Some sections will remain retarded for a long time in the future, but as a whole the South seems assured of playing a much greater part in industry, and in the future overall economy of the nation than it has up to the middle of the twentieth century.

QUESTIONS, EXERCISES, AND PROBLEMS

1. There is every indication that the industrial frontier is moving into the South. Some people ascribe this movement to the cheap labor of the South, some to the tyranny of labor unions in the Northeastern States, others to the excellence of the geographic conditions favoring localization of industries. What do you think is the cause or are the causes? You must be able to present data for your decision.

2. Is the Negro a factor, directly or indirectly, in the development of manufactures in the South?

3. Where in the South, in the future, do you think will be located the larger industrial centers? You must decide what locations in the South are similar to the industrial centers of the Northeastern States in water power, coal resources, iron-ore deposits, petroleum and natural gas, land and water transportation facilities, and contact with markets.

4. The coniferous forests of the South have supplied products to commerce and industry for more than three centuries. Make a thorough study of the forest-products industries and write a paper on the importance of southern forests in the economic life of the people, considering all forest products. For what reasons will the South become an important producer of paper?

5. Make a study of the dock and warehouse facilities provided by the Louisiana state commission at New Orleans. How do they compare with those at St. Louis? At Houston? At Memphis?

6. It is claimed by some people of South Carolina that, had the National Government spent as much money in harbor improvements at Charleston as at New York, Charleston today would be as large as New York. Construct curves of the population growth of both cities. Data may be secured from the *Statistical Abstract* or the *Census Reports*. What geographic and historical factors can you find to explain the differences in the growth of these two cities? What competitors does Charleston have in the South?

7. Look up recent improvements and plans for Charleston harbor, particularly relating to harbor improvements, water supply, and hydroelectric power. Will this make a difference as to Charleston's future growth? How?

CHAPTER 14

The Physiographic Regions of the West

A Preview. "Out where the West begins" is far from being a well-recognized, well-established physical line of demarcation. The Census Bureau, which supplies official statistical data for the sections and political divisions of the United States, fixes the eastern boundaries of the Rocky Mountain States as the beginning of the West. Popular opinion, however, has always thought of the semiarid, grass-covered Great Plains, the home of ranching and cowboys, as one of the most important regional divisions of this most romatic section of the country. But since about 1890, the farming frontier has ever pushed westward, encroaching on the cattle country. Today it is in the western half, approximately, of the Great Plains that the cattle country begins.

The West is a land of contrasts. One finds lands of wonderful fertility on which there is cultivation of the highest intensity, and vast areas of land of almost utter worthlessness where a "cow" requires 70 acres or more for sustenance, or of absolute worthlessness where life is almost nonexistent. There are densely populated cities, and there are immense areas where there is no more evidence of man than when the earliest Spanish explorers traversed the American Southwest. There are areas having subtropical climates and vegetation, and there are areas of ice and snow. There are areas of heavy rainfall, the heaviest on the North American continent, and areas of extreme desert.

The West is the last of the major sections of the United States to be occupied by English-speaking people. It is the youngest, therefore, of these sections, yet one finds man and his industries and institutions, the cultural landscapes, as well established as in the older settled communities of the eastern half of the United States. Since before 1848, the West has dangled wonderful economic attractions before the imagination of men, and hordes of immigrants have kept the trails and traffic lines crowded on their westward trek of one, two, or even three thousand miles to the land of their dreams. Near the beginning of the nineteenth century fur traders and fishermen from New England rounded the Horn or trekked westward to the Columbia River section to win a fortune from stream and mountain forest. In the late 1830's, missionaries from the East established centers of civilization on the Willamette and the Columbia. The first groups of pioneers from the Middle West frontier reached the Willamette Valley in 1839, the vanguard of many thousands that firmly established American civilization in the Oregon country. By 1840, Oregon had a population of some 8000. More than 4000 traversed the Oregon Trail in 1847. In 1848, the discovery of gold started a trek over forest and mountain and grassy and bush-covered plateaus that gave California nearly 93,000 people by 1850. In nearly every section of the entire West during the next 10 years, prospectors were driving shafts into mountain slopes in the fond expectation of becoming rich overnight. By 1860, the Mountain States had 174,000 people, and the Pacific Coast States, 444,000. This was some years before the first transcontinental railway was completed. Most of these 600,000 and more, went westward on foot, horseback, or in ox-drawn or horse-drawn covered wagons. America had never seen such a movement of land and wealth seekers. And gold, silver, copper, zinc, lead, coal, iron ore, forests, grazing lands, irrigated lands, and dry farming have continued to attract thousands of people yearly in search of wealth. For nearly a century the West has been the most rapidly growing major section of the United States. Between 1910 and 1950 the Pacific States trebled in population, and the Mountain States increased by 80 percent. The New England advance was nearly 50 per cent, the East South Central 40, and the West North Central less than 18.

The scenic attractions—massive, lofty, glacial-topped, forest-covered mountains, profound canyons, cloudless skies, many-hued deserts, ancient forests in stone,hot springs, spouting geysers, falls and rivers, giant engineering works, well-kept cities, and even more interesting villages, ancient and modern, of primitive Americans—draw several millions of tourists each year.

Most easterners are astounded at what man has accomplished in the West in the face of seemingly insurmountable obstacles. To the westerner nothing, seemingly, had proved impossible in the past; hence, everything seems possible. Here you find United States optimism, enterprise, and individual accomplishment at the maximum.

The chapters that follow present the natural environmental background of western civilization, and man at work, and his accomplishments. We begin our study with the most fundamental environmental element in the West, the physiography.

General Features and Divisions. Mountains and plateaus dominate the topography of the West. Very little of the area may be considered as plains; even the Great Plains area is considered by many a plateau. Since the plateaus are highlands between mountains or border the mountains, the trend of the major mountain systems determines the trend of the topography. The trend, or the grain, so to speak, of the topography is roughly north and south. An east-west cross section approximately through Denver and San Francisco illustrates well this general feature.

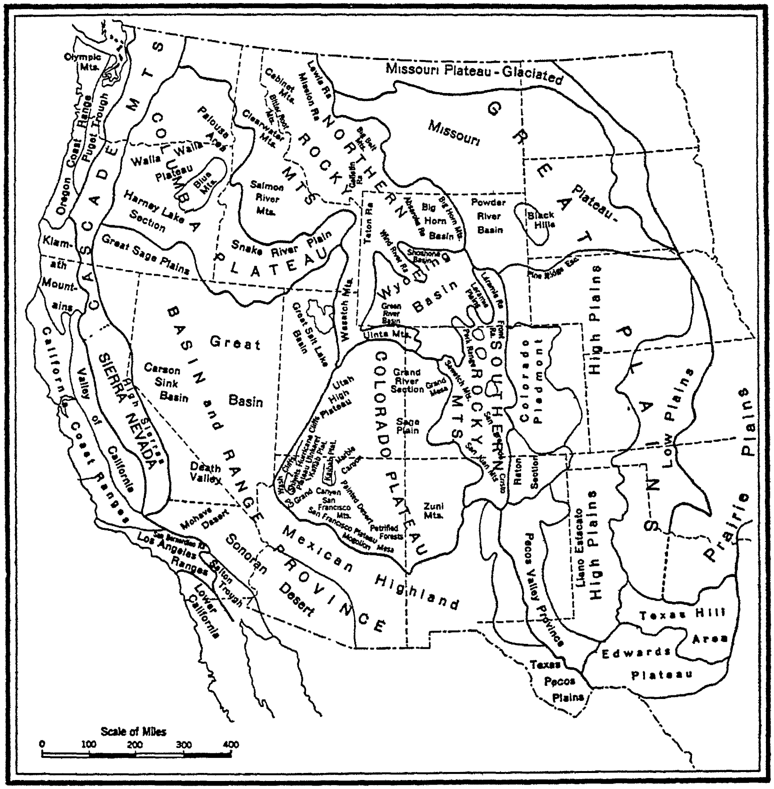

Fig. 155 The physiographic regions of the West. The major divisions are largely based on the monograph of the physiographic divisions of the United States by Fenneman and others.

Four major physiographic regions are recognied: the Rocky Mountain System, the Intermontane Plateaus, the Pacific Slope, and the Great Plains (Figs. 155 and 156).

The Pacific Mountain System. The Pacific Mountain system consists of two rows of mountains, the Coast Ranges on the west, and the Sierra Nevada-Cascade Mountains on the east, with a long valley trough between. The valley trough, however, is interrupted by a mountain mass,

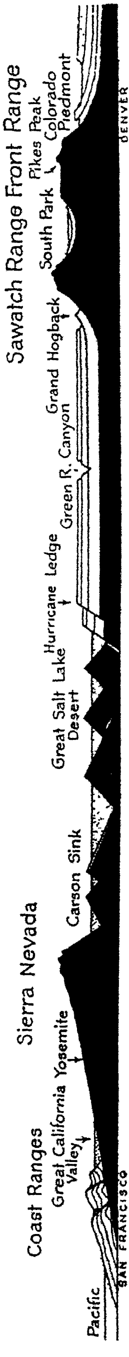

Fig. 156. A generalized cross section of the West at about the latitude of Denver or San Francisco. Compare this section with the map of physiographic regions, Fig. 155. *After A. K. Lobeck.*

the Klamath Mountains, in southern Oregon and northern California, and thus two troughs result, the Puget Sound Trough in the north and the Valley of California, or the California Trough, in the south. South of 34° N. is a third trough, the Salton Sink Trough, the landward continuation of the Gulf of California Depression. Although from a physiographic standpoint the Gulf of California Depression forms a part of the great Pacific Slope Depression which extends from Lynn Canal in Alaska to the tip of Lower California, Salton Sink is generally classed as a basin of the Basin and Range province, and will be so considered in this discussion.

The Coast Range of Oregon and Washington. The Coast Range of Oregon and Washington is low, and is largely a dissected, warped plateau, broken by many rivers. It is a region of rough topography, ill suited for agriculture, except in its valleys, but well adapted to the growing of forests, the oceanic climate being particularly favorable to plant life.

The Klamath Mountain group, which may be considered a part of the Coast Range, for it touches the coast, is a plateau, so thoroughly dissected by the several short, swift rivers that enter the Pacific between 41° and 43° N. that nearly the whole area is in slope. Ridges and peaks are the rule, but erosion has progressed sufficiently to have formed many valleys broad enough to encourage agriculture. The group is a distinct barrier to traffic and communication between the Puget Sound and California troughs (Fig. 157).

The Coast Ranges of California. Southward from the Klamath Mountains to the latitude of Los Angeles, the coastal mountains consist of a series of parallel ranges, some short, some long. Each of the numerous headlands that characterize the California coast is one of these ranges projecting obliquely into the Pacific. The broad, open bays between headlands are, as a rule, the seaward ends of valleys that lie between the ridges. None of the bays, except San Francisco Bay, furnishes shelter to ships; and the high, bold cliffs and strong onshore winds at times make the entire Pacific Coast foreboding to the mariner.

San Francisco Bay, one of the finest harbors of the world, occupies the drowned portion of a structural depression between two ranges, and the entrance to the bay, Golden Gate, is a drowned valley in the outer range. There is also a break through the inner range, so that ocean-going vessels tie up at wharves on the very

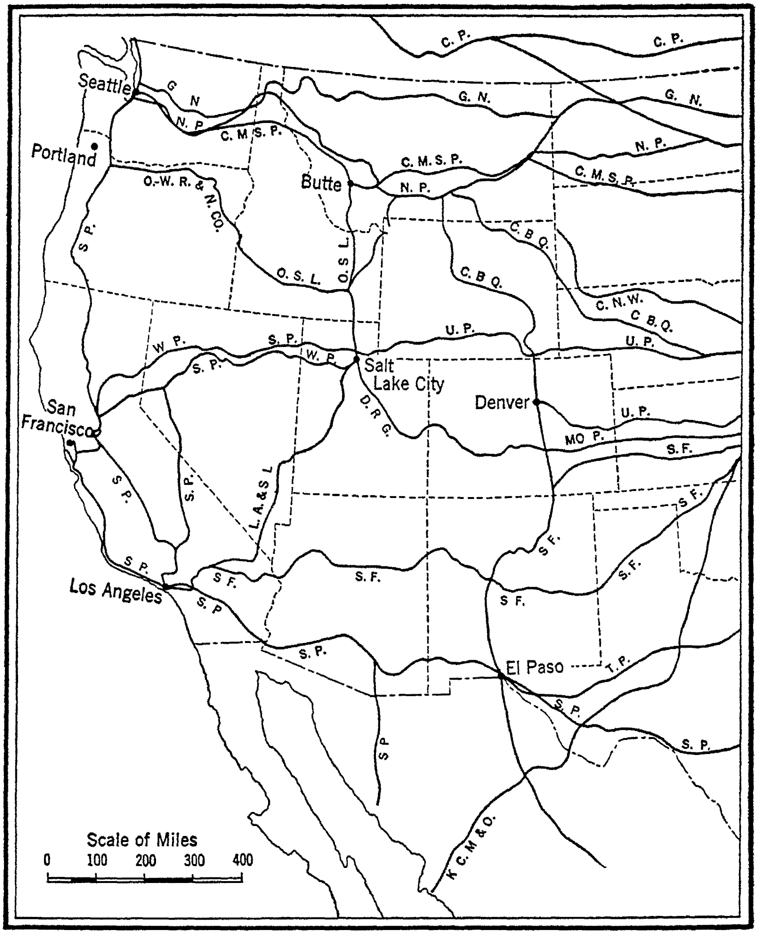

Fig. 157. The important railroads of the West. Railroad building in the West began with the Union and Central Pacific in 1869. The union of these two lines was made near Salt Lake City. Much of the freight carried is "through-traffic" from the humid Pacific slope to the humid East. East and west lines dominate. The Pacific Trough and Rocky Mountains have lines north and south.

edge of the Valley of California. The long shore line of the bay gives ample room for the expansion of the numerous cities.

Southward from Los Angeles, the coastal mountain region consists of a number of short, low ranges, the most prominent being the Santa Ana and San Jacinto. The valleys between the ridges are partly waste filled. The harbors at San Pedro (Los Angeles harbor) and San Diego are on the outer edge of the Coastal Plain bordering the Coast Range. In their present condition they are more the work of man than of nature.

Little of the land of the Coastal Range province is cultivated, largely because of the dominance of slope. In most of northern California and in Oregon and Washington, the dairy farmer and fruit growers have made a start but the lumberman still holds sway over a large area. Southward from 39°, aridity in general limits the cultivable lands to the irrigated valleys.

The Puget Sound Trough. The Puget Sound Trough extends from the Canadian border southward to about 43° 30' N. The northern part of the trough is occupied by Puget Sound, which is bordered by sandy, gravelly plains, and hills largely glacial and fluvio-glacial in origin. The southern limit of the glaciated area is about 15 miles south of the southern end of the sound. The enterprising cities of the trough give a profitable market for the garden truck, dairy products, and deciduous fruits produced on the humid plains bordering them.

Puget Sound is another of the fine harbors of the world; in fact, it is a group of harbors all connected by deep water. The linear distribution of the water surface, mainly transverse to the prevailing winds, and the numerous bordering hills give shipping excellent protection from the wind and waves. Moreover, the harbor is open the year round. The sound is the result of drowning of the northern end of the Puget Trough; in fact, it is the beginning of the long "Inside Passage" that extends northward to Alaska. Glaciation, too, has had its part in widening and deepening the channels of the sound.

The Willamette River, which drains the trough in Oregon for most of its course, is an aggrading stream. It flows through a broad, alluvial plain, 10–15 miles wide in places. Here are to be found the most highly productive portions of Oregon, in fact, some of the best humid farming land in the West. Most of the agricultural land of the trough in Oregon lies on the flood plains of the Willamette, for much of the bordering rolling land and the tributary valleys have been cleared. The chief trading center of the Willamette Valley is Portland, which, though 120 miles inland, is nevertheless an ocean port.

The Valley of California. The Valley of California, 400 miles long and 30–60 miles wide, is drained by two large rivers, the Sacramento and the San Joaquin, and their tributaries. Even in the northern portion the rainfall is not sufficient for humid agriculture, and the southern portion is a bunchgrass-covered semidesert except where irrigation is practiced.

The valley trough is structural, its formation being associated with the tilting that formed the Sierra Nevada and the warping that gave rise to the Coastal Ranges. A long, narrow sea probably once occupied the trough, but alluvial deposits in the form of fans and flood plains have displaced the sea. Deposition is most active along the eastern border of the valley where the swift, copious streams on the western slope of the Sierra Nevada bring down large quantities of detritus and form compound alluvial fans. Much of the surface of the valley to the west of the fans is a dead-level plain on which drainage of even the slight rain is slow and difficult. Marshes are common, the largest being at the junction of the Sacramento and San Joaquin rivers, about Tulare Lake, and near the Marysville Buttes. The deep soil and flat surface of the valley offer excellent conditions for agriculture where the rainfall is sufficient for dry farming, or where water is available for irrigation; and for irrigation the many copious streams from the Sierras are utilized. The tilled land of the northern half of the valley is largely dry farmed; that of the southern half is mostly "under ditch."

The Sierra Nevada-Cascade System. The Sierra Nevada and Cascade Mountains do not form a continuous system. There is a gap in the system in the vicinity of the Feather and Pitt rivers, and here are Mt. Shasta and Lassen Peak, both volcanic in origin, Lassen Peak still being active at times.

The Cascade Mountain region is an elevated upland (probably an elevated peneplain) of sedimentary and granitic rocks above which rise numerous volcanic peaks, the more prominent being Baker, Rainier, St. Helens, Adams, Hood, Jefferson, Pitt, Shasta, and Lassen Peak. Not all the eminences, however, are volcanic in origin; some are monadnocks on the old peneplain surface. In places the Cascades are 60–80 miles wide. Although there are large flat areas on the crest of the main axis, erosion has formed deep valleys on the borders. In the northern section, glaciation has deepened a few of these valleys, the Lake Chelan Valley being the most conspicuous example of this type. Some of the valleys on the eastern slope and bordering lowlands, more easily reclaimed than those on the west because of the scantier forest growth, have become famous as fruit-growing sections. Such are the Wenatchie, the Yakima, and the Hood River Valleys.

The Cascade Range is much more broken in Washington than in Oregon. Not only do the railroads find fairly easy grades to tunnel through the breaks in the range, as at Snoqualmie Pass, Stevens Pass (Cascade Tunnel), and Stampede Pass, but also the westerly winds carry moisture over the range to the Columbia Plateau in Washington, Idaho, and Oregon in quantities sufficient to make the raising of wheat by dry-farming operations possible. The large area of farm lands of southeastern

Washington contrasts strikingly with the nearly worthless desert areas of southeastern Oregon, and this contrast is partly the result of differences in mountain heights and the resulting differences in rainfall.

The Sierra Nevada Range is a huge tilted block, the uplift occuring along the eastern portion of the block. The eastern face is steep; the western slope is gentle but roughened by many deep gorges produced by glaciers and rivers. Some gorges are rift valleys. Southward from the latitude of Sacramento nearly to 36° N., the Sierra block rises to 10,000 feet or more. This is the High Sierras, a region of great beauty and ruggedness with many lofty peaks ranging from 12,000 to more than 14,000 feet.

The Sierras are a barrier to the movements of man, for the passes are few and the entrances to them are far up on the flanks of the mountains, 7000–9000 feet above sea level. It was only after long and diligent search that the pioneers in the 1840's found feasible routes across the mountains.

The Sierras are also a climate barrier. Greater contrasts on the east and west sides of the range in rainfall and temperatures are probably not found in any other part of the world except in the Himalayas. In crossing the Sierras along the Southern Pacific from Reno, one passes from the bleak sagebrush desert, where the annual rainfall is but 8.65 inches, up into fine forests which are a response to abundant rains. Blue Canyon station on the western slope of the mountains, at an elevation of 4701 feet, has a rainfall of 74 inches. The temperature regions traversed also indicate great contrasts. (Study Fig. 4.) The plateau to the east of Reno is in the *Hot Summer and Cold Winter* temperature region. In going up over the mountain range one passes through the *Cold Winter and Mild Summer* belt on the summit and upper slopes into the *Cool Winter and Mild Summer* region on the western slope, and then down into the *Hot Summer and Cool Winter* region of the valley.

The Intermontane Plateaus. The Intermontane Plateaus region, covering the vast area between the Sierra Nevada-Cascade system and the Rocky Mountains, is naturally divided into three subdivisions: the Columbia Plateau, the Basin and Range province, and the Colorado Plateau. Each has its distinct type of topography.

The Columbia River Plateau. The Columbia Plateau, with an area of about 250,000 square miles, has for its bedrock horizontal layers of lavas, which evidently came out of numerous vents at various times, and spread over large areas, burying in most parts the old land surfaces. In some deep canyons in the plateau, 100 distinct layers, representing 100 outflows, may be seen. A few areas, like the Blue Mountains, are higher than the surface of the lava beds and stand like islands surrounded by a lava sea. Weathering, in which physical processes predominate, combined with active wind transportation, has covered the area with a deep soil, dark in color, and highly productive, where moisture is sufficient. The Palouse region in Washington, western Idaho, and Oregon has a dark soil, porous and fine enough to retain a large part of the scanty supply of rain water and give it up to the wheat crop, the dominant agricultural product of the region. The soil of the Palouse country is in color and physical characteristics like that of the eastern edge of the Great Plains.

The Columbia and its tributary, the Snake, are the largest rivers of the Plateau. Although serving as rather important highways of travel and transportation in the past, their chief value today is to furnish water for irrigation and hydroelectric power. The Columbia is one of the greatest salmon streams in the world.

The Basin and Range Province. The Basin and Range province is the largest of the Intermontane Plateaus, extending from about 42° N. to the southern boundaries of the United States, and eastward from the Cascades and the Sierra Nevada ranges to the Rockies, and from the Coast Range in southern California through Arizona and New Mexico to the Great Plains beyond the Rio Grande. The surface features throughout the entire area are very similar, consisting of numerous short ranges and vast stretches of waste plains, the material of which has been deposited by water and winds. Throughout its extent the Basin and Range province is a region of scanty precipitation; the occasional rain that comes falls in a heavy downpour. It is the most arid of the provinces in the West. Its scant rainfall and rapid evaporation and its topographic features are typical of desert lands. All of this Basin and Range province, west and north of the Colordo River, lies in the Great Basin, an area of interior drainage. The Great Basin is really a region of basins, the more prominent being the Great Salt Lake basin, the Carson Sink area, Death Valley, Salton Sink basin, and the Lower Colorado basin.

Great Salt Lake is the shrunken remnant of a large lake, Lake Bonneville, whose surface during the glacial period stood 1000 or more feet above the present level, and which was comparable in area (19,750 square miles) to Lake Michigan. Lake Bonneville was a fresh-water lake, the drainage going northward into Snake River. The terraces of the ancient lake are to be seen as huge benches high on the slopes of the Wasatch Range and the mountains on the western border of the lake basin. The present level of the lake varies from time to time, depending on the relative amount of rain.

With the constant shrinkage that has been going on for thousands of years there has been a concentration of the mineral compounds, until now the water is so salty that animal life is almost precluded, the only permanent life being a small "brine shrimp." Another form seen at some seasons is the larva of a small fly. The density of the water is so great that bathers can float on the surface nearly as easily as a cork floats on fresh water. The Carson Sink basin was also once partly occupied by a large lake in the glacial period, Lake Lahontan, the waters coming from the glaciers in the High Sierras.

Salton Sink basin is the remnant of an arm of the Gulf of California which has been isolated by the formation of the Colorado River delta. In late years the basin has come to be called the Imperial Valley and is one of the most productive irrigated areas in the West. The surface level of the lake is 241 feet below sea level. It is easy, therefore, to secure from the Colorado River water for irrigating the land about the Salton Sea. In 1891 and again in 1905, during periods of high water, the Colorado, to the extent of about 85 per cent of its volume, became diverted toward Salton Sink along a diversion canal which was not provided with gates, and only after much effort and at great expense were the flood waters again directed toward the Gulf and protective dams constructed. Because of its southern location, and the fact that it is in a normal high-pressure

Fig. 158. Scene in the Sonoran Desert in southern Arizona. Here the rainfall is less than 10 inches each year, the vegetation is sparse, and salt or alkalai flats occupy the low areas.

area with bright sunlight, the basin raises all the subtropical crops of both the New World and the Old.

Besides these large basins there are scores of minor basins within the Great Basin that receive the water from the nearby low ridges or surrounding plateau surfaces, and which, during moist periods, are occupied by water that evaporates in dry periods and leaves salt or alkaline incrustations or mud flats. Such lakes are known as salinas, alkali lakes, and playas, respectively (Fig. 158).

Most of the ranges of the Basin and Range province, particularly the shore of the Great Basin, are the fault-block type of mountain, the height and form of which have been greatly modified by erosion. The axes of the ranges are more or less parallel, and all have a north-south trend. About each range are large flat areas of loose mantle rock, spread out in sheets over the volcanic bedrock by wind and water. In California, Arizona, and New Mexico, plains occupy more of the surface by far than mountains. In the Lower Colorado Basin, nearly 90 per cent of the area is flat or nearly flat land, and thus large areas are topographically suitable for irrigation.

Except in the Humbolt River basin, in the Carson Sink area, and the Imperial Valley, there is little irrigation in the Great Basin, for water is very scarce.

The Colorado Plateau. The Colorado Plateau, the third division of the Intermontane Plateaus, is higher than the Basin and Range province. Although there has been some faulting and movement of blocks, little tilting and practically no folding has occurred. The plateau is characterized by deep gorges. The highest portion of the plateau is a broad zone along the western and southwestern edge from central Utah into New Mexico. The rainfall over much of the plateau is sufficient to grow a fair supply of grasses and edible weeds for summer grazing. The higher portions of the plateau have enough moisture for a good stand of pine, and are largely held as national forests and lumbered under the direction of the Forest Service.

The canyons of the Colorado, the Grand Canyon being the most impressive, are probably the most conspicuous topographic features of the Colorado Plateau and are distinct barriers to communication and transportation.

As a whole, the Colorado Plateau province is thinly settled. There are a few rather progressive little towns, whose economic life depends on mining, repair work at railroad shops, lumbering, and grazing. Agriculture, necessarily based on irrigation, is little practiced except in western Colorado and central Utah near the headwaters of some of the tributaries of the upper Colorado River. Grazing is the leading industry, the stations along the Santa Fe, the only railroad of the plateau except the Denver and Rio Grande in the far north, receiving cattle from ranches scores of miles distant. The Indians on their reservations are among the most active of the pastoralists.

The Rocky Mountain Province. The Rocky Mountain province is a broad, elevated tract 1200 miles long and 200 miles wide, on the average. It is made up of a large number of more or less parallel ranges, few of them more than 200 or 300 miles long, separated by numerous valleys and basins. Like the Sierra Nevada-Cascade system, the Rocky Mountain system is divided into a Northern Rocky Mountain Province and a Southern Rocky Mountain province, separated by a stretch of lower land in Wyoming, known as the Wyoming or Great Divide basin. The Wyoming basin is topographically a continuation of the Great Plains to the east and the Colorado Plateau to the south. Because of the easy approach from the east and the low passes across the Rocky Mountains, the routes of the earliest overland trails and the first trans-Rocky Mountain railroad were located in Wyoming. (Location also a factor.)

The Northern Rockies. The Northern Rockies are widest in Montana, and here are the largest number of ranges—the Big Belt, Little Belt, Gallatin, Lewis, Mission, Kootenai, Cabinet, and others. In the vicinity of Yellowstone Park the system is narrow, but southward several ranges spread out like a fan from the lofty Yellowstone Park Plateau. The courses of the rivers are determined only in part by the mountain ranges and the trenches. Some streams flow across the trenches and cut through mountain ranges with little regard to the trend of the major topographic features. This condition makes the Northern Rockies in Montana so easily, comparatively speaking, traversed by the trans-Rocky Mountain railroads. Civilization is concerned chiefly with the valleys, basins, and trenches; here are the agricultural lands, cities, and railroads. The mountains, owing to the moderate rainfall and low evaporation, are well forested and are little visited except by hunter, trapper, lumberman, or forester. The National Forests, particularly where transportation is provided, are great attractions for tourists. In general the forested mountains are of inestimable value to the irrigation farmers of Montana.

In central Idaho, to the west of the Bitter Root Range, is a large mountain pass, produced by the intensive erosion of a high plateau. There is little or no system to the ridges except that their direction bears a fairly definite relation to the drainage lines, the result of erosion. Those in the Clearwater River basin are called Clearwater Mountains, and the Salmon River group lies in the Salmon River basin. The many canyonlike valleys give little opportunity, even though the rainfall is sufficient, for agriculture. Through railroads have shunned the region. The whole area, more than twice the size of Massachusetts, has only about 20,000 people.

The principal ranges in northern and western Wyoming are the Absaroka, the Shoshone, the Big Horn, the Wind River, and the Teton. Between the Absaroka Range and the Big Horn Mountains is the Big Horn basin. Although the rainfall is less than 10 inches a year, the basin is irrigated by numerous streams that come from the bordering mountains, and the 308,000 acres of irrigated lands are highly productive. South of Yellowstone Park and at the east base of the Teton Range is Jackson Hole, an intermontane basin that contains Jackson Lake and several smaller lakes which drain into the Snake River. Forests, marshes, and lakes serve as regulators and natural storage areas along the main course of the Snake in Idaho, Oregon, and Washington. The Big Horn Mountain group is similar in general character and origin to the Black Hills and the Uinta Mountains, all three being domes more or less dissected.

Another important range of the Northern Rockies is the Wasatch in northern Utah. The great longitudinal extent of the Wasatch Range and its height of 4000-6000 feet above the Great Salt Lake Plains on the west, and the steep slopes, give many difficulties to the railroad and road builders. Fortunately, a few antecedent streams have cut gorges across the range, and these offer feasible routes. The Oregon Trail avoided the range, making a sharp turn to the north at its eastern base, but the Mormon Road crossed the Wasatch in the latitude of Salt Lake City, through Emigrant Pass. The Denver, Rio Grande and Western Railroad reaches the Great Salt Lake Plains by way of the Spanish Fork, and the Union Pacific through Weber Canyon. The chief value of the range to man, besides its mineral resources, is the water that falls on its western slopes and that has been directed with great skill upon the thirsty, sagebrush Piedmont Plains. In 1929 there were 1,350,000 acres of irrigated land at the base of the Wasatch, carefully tilled and highly productive, a vast oasis in still vaster stretches of sagebrush and greasewood desert plains. The area under irrigation here has not been extended much because the limit of possibility has been reached.

The Southern Rockies. The Southern Rocky Mountain province is, throughout its length, a double row of ridges with basins between. The two ridges are remnants of two more or less continuous parallel folds with a synclinal depression between. Erosion has removed most of the sedimentary rock from the ridges, exposing the igneous cores; but sedimentary material is to be found in the hogbacks on either side of the ranges and in the intermontane basins.

In southern Wyoming, the Laramie Range, the eastern front range, is a low, folded mountain. The summit is a gently rolling peneplain. The approach from either side of the crest at Sherman (8009 feet) is very gentle. The Union Pacific Railroad crosses the Laramie Range with low grades. To the west of the Laramie Range, in southern Wyoming, is the Medicine Bow Range, and between the two is the broad Laramie basin or Plains.

The Front Range in Colorado is the easternmost range, as the name implies. Its serrated crest and towering peaks, which rise 13,000–14,000 or more feet above sea level, may be seen from points on the High Plains scores of miles distant. Pikes Peak has an elevation of 14,110 feet, and Longs Peak is 14,225 feet. Much of the summit of the Front Range, as seen from an elevated position like Pikes Peak, is an upland cut by many deep canyons, yet also with a large acreage of relatively flat land and capable of supporting large flocks and herds during the warm season. Glaciation has been active in the past. Cirques, lakes, and moraines are common features in the upland areas and add much to their picturesqueness. The Front Range extends only to the Arkansas River, beyond which the Wet Mountains become the front range. Farther south, the Sangre de Cristo, which extends into New Mexico even beyond Santa Fe, is the easternmost range.

The western series of mountain ridges of the Southern Rocky system is formed by the Park Range, the Sawatch, and the San Juan Mountains. There are a few other ranges in west central Colorado, which belong to the Southern Rocky Mountain system, but they are of minor importance.

The small intermontane basins of the Rockies, called "parks," are from north to south, North Park, Middle Park, South Park, and San Luis Park. On the eastern slope of the Front Range is Estes Park, much visited by tourists. The parks, although they lie between prominent ranges with their north and south rims much lower than the east and west mountain borders, are isolated from each other, and their drainage waters take devious routes. North Park drains into the Platte by way of the North Platte River. The waters of South Park pass eastward through Royal Gorge, carved in the front range by the South Platte; and San Luis Park is drained by the Rio Grande.

The basin floor of the parks is fairly level, the basins being waste filled; but Middle Park has a hilly surface. San Luis Park, the largest, offers exceedingly attractive opportunities for agriculture. Its surface is as level as the bed of a lake, and the land is easily irrigated and easily drained.

Colorado has by far a larger number of lofty peaks and a larger area of land above 10,000 feet than any other state. There are 180 peaks that exceed 12,000 feet in height, more than 110 above 13,000, and over 50 that rise to heights of more than 14,000 feet. The large area of high land athwart the eastward drift of the air in the *Westerlies* is the explanation for the relatively heavy rainfall, which makes possible the large area of valuable commercial timber and supplies water to the 3,390,000 acres of land that have been irrigated in the state, as well as to many thousands of acres beyond the borders. Colorado, although an interior state 700 or more miles from the Pacific, ranks second among the states of the West in number of acres of land irrigated. The mountains and ridges, however valuable they may be to the timber industry and agriculture, indirectly, are a barrier to east and west traffic; and the railroads that do cross the Rockies in Colorado have spent huge sums in bridging canyons and tunneling mountains. They make frequent use of "horseshoe" curves in order to reduce grades, yet their traction costs are heavy.

The Great Divide Basin. The Wyoming or Great Divide basin, surrounded on almost all sides by ridges of mountains, receives less than 10 inches of rain. (This is approximately the rainfall of the Green River basin, the Big Horn basin, and the Wind River basin in Wyoming also.) It has all the characteristics of a true desert. The streams that flow from the surrounding ridges lose themselves in the sands, or their waters spread out into flats that become playas or salinas. Near the western edge of this basin and in the lowest portion is the Red Desert, an area of drifting sand of various colors—vermilion, brick red, and russet, even green, purple, gray, and yellow. The bunchgrass is so scant and so scattered that the color of the landscape is determined largely by the colors of the sands that nearly everywhere mantle the surface. Barren and desolate as the landscape is, there are periods of the year, particularly in the winter, when large herds of cattle and sheep find pasturage here.

The Great Plains.[1] The Great Plains province is undoubtedly, next to the Coastal Plain, one of the most unified in surface features of the physiographic provinces of the United States. Its north and south extent is about 1400 miles and its width approximately 400. Could its original surface be restored, it would be a gently sloping plain, not unlike the Atlantic Coastal Plain, in many of its features. The rock material forming its strata has been derived largely from the Rocky Mountain area to the west. The lower strata of sandstone, shales, and limestones dip gently eastward, but are synclinal in structure, and at the western edge are sharply upturned, particularly in Colorado (in the Garden of the Gods they stand almost vertical) as if they once extended over the exposed core of the Rocky Mountains. On the top of these older consolidated deposits are younger sands, gravels, and mud, only partly indurated. These, too, slope eastward. Erosion in some parts has been very active, probably amounting to several thousands of feet. The western border at present has an elevation of about 6000 feet above sea level in the central or Wyoming-Colorado region, and 4000 feet to the north and south.

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[1] Only the western edge of the Great Plains province is within the Western States as delimited by the Census Bureau, but considered from the standpoint of climate and land utilization the wholeprovince may be included in the West. In the minds of the general public it is western. In this book the province is discussed along with the other natural regions of the Western States, but census data, unless otherwise stated, are for the 11 states that the Census Bureau calls the West.

North of the northern boundary of Nebraska, more exactly the Pine Ridge Escarpment, the Great Plains slope all the way from the mountains, with little or no interruption except for a few isolated hills whose flat tops indicate the level of the former surface of the plain, to the Missouri River. This portion of the province is the Missouri Plateau. The eastern edge of the plateau is the Missouri Coteau, an escarpment 200–600 feet high in places. North and east of the Missouri River the plateau has been under the ice of the Keewatin ice sheet and has typical morainic topography. Although the Missouri Plateau has no more rain than the Great Plains farther south, the cooler summer temperature does not make for excessive evaporation in much of the area, and dry farming is fairly successful. The rivers from the Northern Rockies supply much water for the irrigation of lands in the Missouri Plateau.

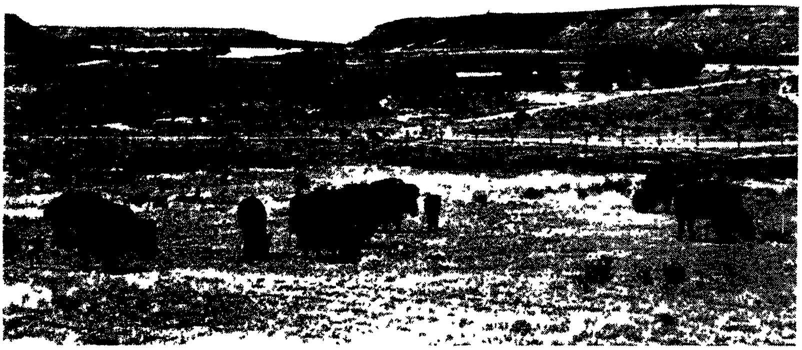

Fig. 159. High Plains landforms in Scott County, Kansas. *Courtesy, Kansas State Chamber of Commerce.* The High Plains are broken much by valleys where floods may be damaging after heavy rains in the mountains to the west. Such valleys afford good grazing for parts of the year. The bison was originally at home on these plains, but those shown in the picture are in a park.

South of the Pine Ridge Escarpment, three distinct types of topography are recognized in the surface features of the Great Plains. These are arranged in north and south belts. The central belt, in which much of the original strata of sand and gravel are preserved and which stands higher in general than the belts east and west, is the High Plains. In most of Nebraska the High Plains extend across the Great Plains province, but farther south the belt is only about 200 miles wide. In western Texas the High Plains are known as the Llano Estacado, and farther south as the Edwards Plateau. To the east of the High Plains are the Low Plains, the line of separation being in general a low escarpment called the Break of the Plains. Erosion is more rapid along the western edge of the Low Plains than in the most of the High Plains, because the rainfall is greater. The streams are constantly shifting the western boundary as they erode into the steeper lands at the Break of the Plains (Fig. 159).

Along the western edge of the Great Plains between the High Plains and the Rockies is a long, narrow strip, more or less continuous, in which erosion has been active and which has formed a series of troughs or holes, or basins, not unlike an "inner lowland." In western Nebraska is the Goshen Hole, carved by the many tributaries of the North Platte. In Colorado is the Colorado Piedmont, eroded by the South Platte and the Arkansas and their tributaries; and in New Mexico and western Texas is the Pecos Valley. All the major streams and some of the tributaries in the inner lowland belt are supplied with water from the mountains and are therefore able to erode actively. The bedrock in this area, in the early part of the present cycle of erosion, was higher than that to the east, and, as in all "inner lowland areas," was subject to rapid erosion. The upturned edges of some of the strata present points of attack for weathering agencies. Moreover, the plant life is scanty and thus does not form a protective cover against erosion, as it does farther east. These are probably the reasons for the formation of the "inner lowland" areas.

The Great Plains province has the largest area of continuous agricultural and grazing land in the West. The province is a transition zone between the humid East and the arid West, a transition zone in topography, soil, climate, plant life, and land utilization. For this reason the boundaries delimiting it as a whole, or delimiting its divisions, are open to dispute. Its western boundaries and the boundaries of its three divisions are fixed readily by natural features, but the eastern limits are located more or less arbitrarily. The soil student recognizes the western boundary as decided on by the physiographer, and for the eastern boundary uses color of soil as a criterion to delimit the divisions. Three belts or divisions are recognized: an eastern Chernozem belt; a middle Dark Brown soil belt; and a western Brown Soil belt. The amount of humus in the soil, which affects the color, decreases westward. Soil profiles show, on the other hand, an increasing amount of calcareous material in the soil, increasing in percentage and thickness but decreasing in depth toward the west. The calcareous layer measures the depth of root penetration. Both color of soil and depth and thickness of calcareous layers are responses to the amount of rain and the depth to which the rain penetrates. The Chernozem belt lies in general to the east of the 20-inch isohyet.

The ecologist recognizes three belts of plant formation, and the agriculturist three belts based on man's utilization of the land. In the Chernozem soil belt, grain growing dominates the agrictultural activities, with livestock-raising subordinate. In the Dark Brown belt, farming is less certain than in the belt to the east, and livestock often tides the farmer over lean years. This is therefore, a farming-grazing belt. In the westernmost belt, grazing predominates.

QUESTIONS, EXERCISES, AND PROBLEMS

1. Do you think the railroads of the West are justified in advising Americans to "See America first"? List the "natural wonders" of the West visited by tourists Of what economic value to the West are these recreation grounds? To what extent has the National Government contributed to the recreation business of the West? Make a list of the National Parks and Monuments. What are the natural features in each that attract people? Write to the Department of the Interior, Washington, D. C., for booklets on National Parks and Monuments. What types of business in the West are benefited by the tourist trade?
2. Plan three journeys across the Western States, one in the North, one along the overland route to California, and one in the South. Write descriptions of or reports on the more important natural geographic features and human activities that one would see along each route.
3. What physiographic features located the first railroad to the Pacific Coast along the central route?
4. Make a study of the natural features of Puget Sound, the lower Columbia River, and San Francisco Bay as harbors. Make detailed sketches. How did Los Angeles provide for a commercial contact with the Pacific? What adverse conditions did it overcome?

CHAPTER 15

The Climate of the West

The dominating factor in the geography of the West is aridity. Its influence is seen in many ways: in the topographic forms, in the chemical composition and physical characteristics of the soil, in the character and distribution of plant life, in man's utilization of the land, in the architecture of the homes, the density and distribution of population, the wealth of the people, and the distribution and mileage of roads and railroads. In this chapter are discussed the distribution of rainfall and temperatures, climatic plant geography, land utilization, and density and distribution of population.[1]

RAINFALL

Areas of Rainfall Regions. The West, as delimited by the Census Bureau, has an area of 1,189,000 square miles; but if aridity be taken as the criterion the eastern boundary is the 20-inch isohyet, or approximately the 100th meridian. This larger West has an approximate area of 1,300,000 square miles, more than two-fifths of the area of the continental United States, exclusive of Alaska.

Of this vast area, only about 135,000 square miles, mainly the Pacific Slope north of 37° and north central of Idaho, have a rainfall of 30 inches or more, the amount generally considered essential in intermediate latitudes, if well distributed seasonally, for the more productive phases of humid agriculture. Much of this area is too rugged to be utilized for large-scale agriculture as now practiced in the United States. Even within the region commonly considered as the humid portion of the Pacific Slope, some of the valleys, particularly in southern Oregon and northern California, in the rainshadow of the Coast Range, are semihumid and re-

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[1] In no section of the United States is human adjustment to climatic conditions quite so evident as in the Western States. In northern Canada and the West, climatic influences are so all-powerful that they approach controls. For these reasons a chapter is being devoted to the climate of the West instead of making climate incidental to the other phases of the geography as is done in most other sectional treatments.

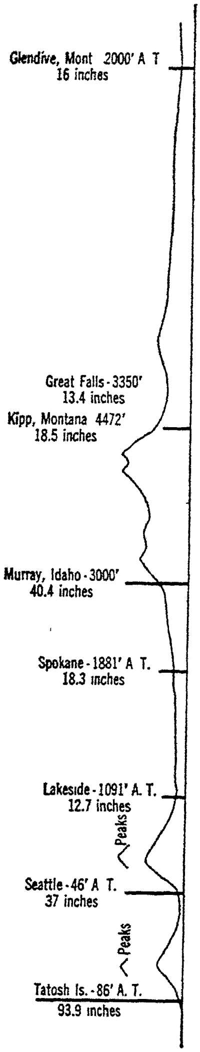


Fig. 160. Rainfall along an east-west section from Seattle to Great Falls.

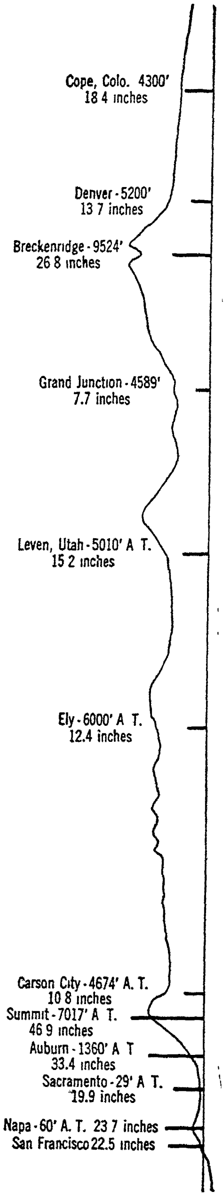


Fig. 161 Rainfall along an east-west section from San Francisco to Denver.

quire irrigation for profitable agriculture. About 900,000 square miles (some 70 per cent) have 10-20 inches of rain a year; and 240,000 square miles (about 18 per cent), less than 10 inches. More than 60,000 square miles are absolute desert.

Generalizations as to Rainfall Regions. The distribution of rainfall and its causes are discussed in Chapter 1. Only a few generalizations need to be made here. In general, in much of the West, the quantity of rainfall is a function of the altitude and location with respect to the ocean and winds. The regions of heavy and of very heavy rainfall, 40 inches or more, are on the westward-facing slopes of the Coast Ranges and the Sierra Nevada-Cascade Mountains, north of 37°, approximately. North of 39°, most of the higher slopes of the mountains receive 60 inches or more, and a few small areas 100 inches or more. Areas having 30-40 inches are to be found in Idaho north of 44°, and on a few of the higher mountain masses in Colorado. Most of the 20–30-inch areas are on mountains and plateaus of moderate elevation, as in California south of 37°, in Arizona, Colorado, Wyoming, Montana, and Idaho. In general, the basins or lowlands in the lee of the higher mountains, and plateaus have less than 20 inches of rain (Figs. 160 and 161). The large area that lies between the Pacific mountains and the Rockies, with the exception of a plateau area near central Arizona and a mountain area in northeastern Oregon, is very arid. The climatic deserts are in portions of the less-than-10-inch rainfall areas.

The seasonal distribution of rainfall, as discussed earlier, is a factor of large importance in plant growth, both native and cultivated. On the whole Pacific Slope, west of the Sierra Nevada-Cascade Mountains, and on a part of the Intermontane Plateau to the east, 30–50 or more per cent of the rainfall comes in the fall and winter months. In this large area the growing season is relatively dry. This is particularly the condition over the largest part of California, most of which has 50 per cent of the rain in the winter months. The summer droughts affect not only the plant life but also the constancy of the water supply for domestic use, for irrigation, and for water power. In most of the remaining area of the West the rain comes in summer or early spring or is more or less evenly distributed throughout the year.

TEMPERATURE

The great range in altitude and latitude and the wide longitudinal extent from the shores of the Pacific to the interior of the continent are the reasons for the great variety of temperature types. (See Figs. 4 and 9 and the discussion in Chapter 1.) One of the striking characteristics of the geography of the West, no doubt, is the strong contrast in temperature conditions between the mountain section of the interior and the Pacific Slope.

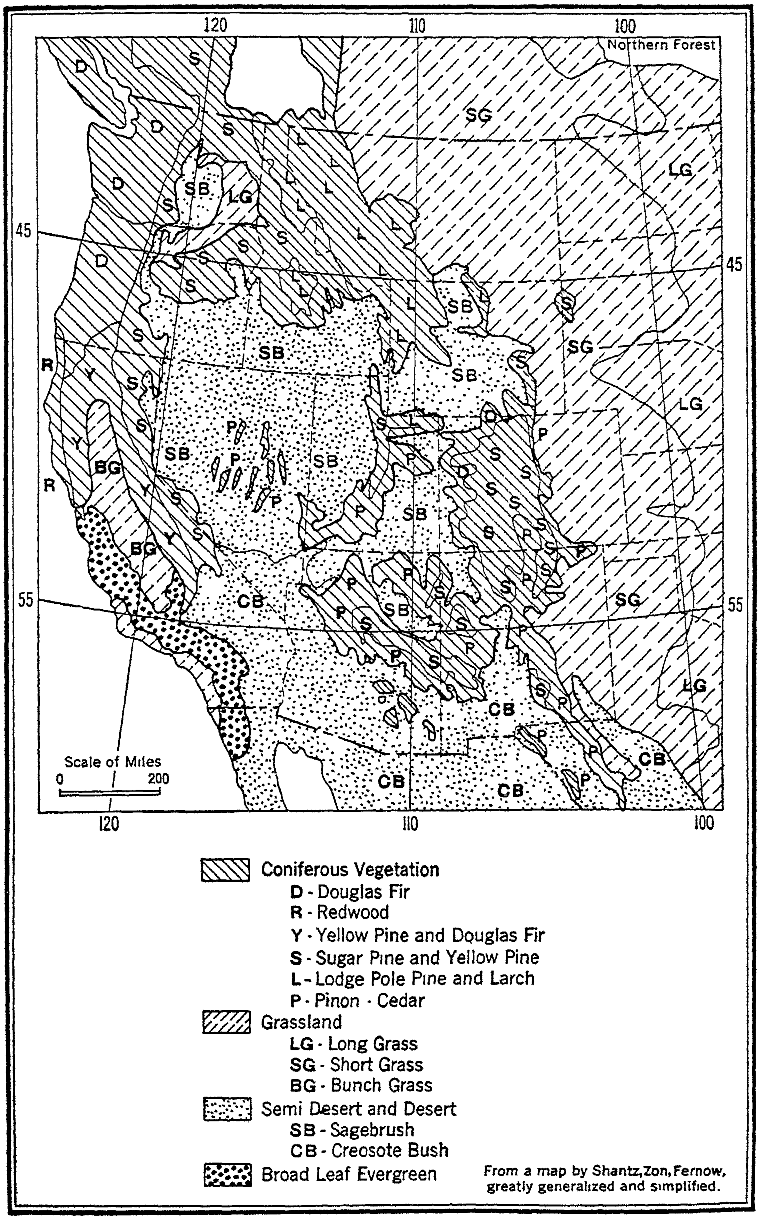
Temperature Regions. As a result of the dominance of plateaus and mountains, surface temperature regions extend into much lower latitudes than in the eastern United States. The *Cold Winter and Mild Summer* type of temperature has its greatest areal development in Canada and in the West, even as far south as northern New Mexico in the Rocky Mountain highlands. It also occurs in the Sierra Nevada and in eastern Colorado. A 90-day (or less) frostless season—generally considered the growing season—covers a large area. Only a small part of this mountain plateau section has more than 150 days free from frost each year. Mountains and plateaus, therefore, bring Canadian lowland temperatures far south into the United States.

The West, from the highest mountains to the lowest basins, has all the temperature regions recognized, except the truly tropical, i.e., the *always hot.* All types except this one occur in California, the only state that is so distinguished.

PLANT GEOGRAPHY

Factors Affecting Plant Life. Many elements of the physical environment affect the distribution and characteristics of plant life. Among the more important are mineral composition and physical condition (depth, porosity, size of particles, humus content, topographic position) of the soil, the amount of rainfall and its seasonal distribution, the length of droughts, the humidity of the air, winds, temperature of air and ground, length of growing day, length of growing season, and amount of sunlight. With so many factors involved, the correlation of plant life and physical conditions is a difficult task and one in which errors are likely to arise, particularly where attempts are made at simplification seems essential. When large areas and slight differences in plant life are thought of, soil, temperature, and rainfall may be taken as the chief elements of the climatic environment. In fact, nearly all the factors stated above are variants or resultants of these three. In the brief discussion that follows, in which an attempt is made to indicate possible correlations between plant types and physical conditions, these three are the elements considered in the physical environment (Fig. 162).

A study of the characteristics and distribution of the native plant life of the West is primarily a question of available soil moisture and water demands. The physical conditions of the soil greatly affect the available supply of soil water. The rainfall is never great enough to saturate the



From a map by Shantz, Zon, Fernow, greatly generalized and simplified.

Fig. 162. Plant regions of the West.

soils to great depths; the subsoil in most of the arid region is permanently dry. After a rain, water penetrates the ground, in heavy soils, not more than 6 or 8 inches, in light soils, 1 or 2 feet. The depth of penetration is also affected by the amount of rain and other factors. From this upper layer, the roots take up the water and the plant gives it to the air by transpiration. Some water is lost by evaporation from the soil. In heavier soils the growth of vegetation may be rapid, but the supply of moisture is quickly used up, and the plants early begin to show the effects of drought. On the light soils, since penetration is deeper and there is little movement of water upward or laterally, the plants must send their roots to the soil water. The plant life on light soils is not so luxuriant as in fine or heavy soils, but the growing season is longer because there is a greater supply of water. Fortunately for plant life, light soils predominate in the West. The sink-in is relatively greater than in humid lands, for the soil is porous. The heavy downpours that characterize the rainfall of the arid areas, unfortunately, tend to reduce sink-in, the surface water running off into mud or alkali flats or into streams, with the result that it is largely lost to plant life.

The water demands of the plants vary greatly, being correlated more closely with evaporation rate than with other climatic elements. As a general rule, plants in the southern part of the arid lands require about twice as much water as in the north. It has been found that 518 tons of water are needed to produce 1 ton of dry alfalfa at Williston, North Dakota, but 1005 tons are required at Dalhart, Texas.[2] This difference is due primarily to the greater amount of transpiration into the hot, dry air of the south. In many parts of the Great Basin, where rainfall is 10 inches or less, the annual evaporation from a free surface is roughly 100 inches. In most of the Basin and Range provinces, precipitation is only about 20 per cent of the evaporation from a free surface, measured in inches.

Types of the Conifers. In the humid and subhumid parts of the West, coniferous forests predominate. Broad-leaved hardwood forests, like those in humid eastern United States or humid northeastern Europe, where climatic conditions are essentially like those of the Pacific Northwest, are wanting. Some plant geographers have suggested that the absence of broad-leaved deciduous trees is a question of dispersal, mountain barriers and aridity preventing migration from the East, the nearest center from which dispersal could take place. The question, however, is unsettled. Climatic conditions may not account for the absence of deciduous trees, but there seems to be a definite correlation, in a rough way at least, of size of tree and density of stand to amount of rainfall, and of species to climate, soil, and moisture. Six types of coniferous forests are recognized in the West. Figure 162 shows the distribution of the several types. The pinion-juniper plant formation, also coniferous, is a woodland. It grows on the desert edge of the coniferous forests (Fig. 163).

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[2] Briggs and Shantz, Second Pan-American Scientific Congress, Washington, 1915–1916.

Sclerophyll Vegetation. The broad-leaved evergreen, or broad-leaved sclerophyll, chiefly of California south of San Francisco Bay, is a plant type that develops in areas that are semihumid, with winter rain and summer drought, and that have moderate winter temperatures. The drought comes in the growing season when the temperatures are high and the air dry. To survive under natural conditions, the plants must therefore possess drought-resisting devices. The local name for this formation is chaparral, but the formation is readily correlated with the well-known mediterranean type, being characterized by trees with leathery, strongly cutinized, evergreen leaves, thick bark, short, knotty trunks, gnarly branches, and a large root development. Bulbous or tuberous biennials are numerous, and there are some succulent plants like the cactus.

Fig. 163. Pines in the high and cool Gallatin National Forest of Montana, showing Ha-Nana Lake. *Courtesy, Forest Service.* This resort and camp is noted for scenery. Here the precipitation is uniform throughout the year, but the land is too rocky and mountainous for agriculture Sheep are sometimes driven in for summer pasture.

Desert Vegetation Types. There are three main types of desert and semidesert vegetation in the Western States: a northern or semidesert sagebrush type, mainly on the Intermontane Plateau between 37° and 44° N. latitude; a southern or creosote-brush type in desert areas south of 37°, and mainly in the area that has 10 inches or less of rain a year; and a third type where the mantle rock is composed of shifting sands or is highly alkaline, which is not a climatic but largely an edaphic desert, the result probably of geologic or topographic conditions. Succulent plants are more characteristic of this edaphic desert than of the climatic. Salinas or salt plains have a fourth type known as greasewood. This type occupies but a small area in the West. The annuals, or rather wet-season plants, of the desert have few of the above characteristics. They are mesophytic in structure and physiology. They germinate after a rain, if temperature conditions are favorable, and grow as long as there is a supply of moisture; as the supply decreases, they blossom, produce seeds, and die as the supply is exhausted. The seeds lie dormant in the desert sands until the next wet spell, which may occur in a few days, months, or even years. The annuals change the barren desert landscape into flowery meadows, ephemeral at best.

LAND UTILIZATION

The humid coniferous forest regions, those of the Pacific Northwest and the Northern Rockies, where topographic conditions permit, are suitable for humid agriculture. Dry farming is possible in most of the Great Plains grasslands and the grasslands of California, the yellow sugar pine areas, and the chaparral. Some of the sagebrush lands are dry-farmed, although agricultural operations are often precarious. Failure is certain in the creosote-brush rea. Irrigation is possible in any of the areas if water is available; but in the creosote-brush area the soil, if strongly alkaline, needs to be freed of alkali by repeated washings. Most of the edaphic, salt, and alkali deserts are probably impossible of reclamation. Grazing is possible on all the non-agricultural lands, but the carrying power of the ranges varies greatly. Their capacity is influenced largely by the relative amount of rainfall and evaporation. (See discussion on grazing, Chapter 17.)

DISTRIBUTION OF POPULATION

The Population of the Future. The type of ultimate land utilization (see also Chapter 2) is an index of the future population that may be supported. Close settlement is possible in the humid areas, where topographic conditions permit, and on irrigated lands; both dry-land farming and grazing make for scattered and few people. The humid area of the West is roughly only about 7 per cent of the total area, and only a small part of this has slopes low enough for cultivation. Careful calculations show that not more than 5 per cent of the arid land west of the 20-inch isohyet may be irrigated, even when all available water is utilized, unless economies in the use of water not now practiced are discovered. Probably, therefore, not more than 10 per cent of the entire area of the western states can ultimately have well-peopled settlements. There is no way of determining or estimating the future density of population that may exist on this 10 per cent of area, for commerce, manufacturing, and mining set no limits to population density; but 90 per cent of the total area is destined to remain a region (or regions) of scattered houses with densities but little greater than at present.

Factors in Population Distribution. Today the West, although 20 per cent larger in area than the North and 34 per cent larger than the South, has only about one-third of the population of the South and one-sixth that of the North. Aridity is not the sole factor that limits the number of people, for the West is younger than the East, but it is certainly the chief factor. The people, in general, may be found largely on the humid lowlands of the Pacific Northwest, on the irrigated lands, and in the mining sections.

QUESTIONS, EXERCISES, AND PROBLEMS

1 Construct a structure section similar to Fig. 161 along a line through San Diego, Tucson, and El Paso. Secure data from Weather Bureau bulletins or from the Statistical Abstract.

2. Draw a structure section across the Pacific Slope and indicate thereon the temperature regions. Explain the location of each region

3. Make a detailed study of the rainfall and temperature types of California in relation to surface features. Write your findings, giving explanations.

4. What correlation do you make between vegetation and climate in California?

5. Make a careful study of the relation of distribution of population and water supply for agriculture in the West.

6. What are the climatic and physiographic reasons for the general lack of navigable rivers and the dominance of railroads in transportation?

7 Why was it that the National Government had to encourage western railroad building by grants of land?

8. Why is it that reds, browns, and yellows are the dominant colors in the landscapes of the West?

9. What climatic conditions make the resort and recreational business of Colorado, New Mexico, Arizona, and southern California profitable?Write to the chambers of commerce of cities in these regions for literature.

10. The securing of an adequate supply of pure water is a difficult problem for every city that attains any great size. In the humid portions of the United States, the large cities have spent tens of millions of dollars each to provide suitable supplies of water. In the arid and semiarid portions of the United States the problem is still more difficult of solution. Make a careful study of the ways in which San Francisco, Portland, and Los Angeles have solved the problem. Emphasize, first of all, the adverse physical conditions they had to overcome, the opportunities nature offers, and how these opportunities were utilized.

CHAPTER 16

Agriculture in the West

In any discussion of agriculture in the West it must be noted immediately that this section does not rank highly when compared with other parts of the country. In 1950 there were 1,158,000,000 acres listed as "land in farms" in the United States, and the West accounted for 324,500,000 acres, or only about 28 per cent regardless of the fact that more than one-third the area of the country is in this section. Steep mountainous slopes, bare rocks, and aridity are the limiting factors. Well over two-thirds of the West is classed as arid and semiarid. However, since the West contains only about 12.8 per cent of the population of the country, agriculture becomes relatively an important business of the people. Considering land in farms, the United States has about 700 acres in farms per 100 of its population; the West has about 1620 acres per 100.

There are three types of agriculture practiced in the West, each adapted to particular conditions. They are (1) irrigation farming, widely distributed and found in all states; (2) dry-land farming, most successful in the Great Plains and in the northern half of the Rocky Mountain area and the Intermontane Plateau area, but also found in all other states; and (3) humid agriculture, almost entirely limited to the Pacific Northwest.

In humid farming and dry-land farming, man uses the moisture as nature distributes it. In humid farming the water is generally so plentiful that man gives little heed to its conservation. In dry-land farming precipitation is so slight that he is forced to use every device that experience and science have taught him to conserve it in order that he may have enough to supply the crops. In irrigation farming man is not satisfied with nature's distribution. He collects the water from a large area, or utilizes nature's devices for collecting it, and distributes it over a small area. All three types require rain; hence the amount and distribution of the rainfall of the West, discussed previously, are as much determining factors in the amount of crops as they are in humid America; and even more so, for the total amount of water is nearer the minimum requirement in the West than in the North and South.

IRRIGATION AGRICULTURE

In all states west of the Mississippi River irrigation is practiced to a considerable extent except perhaps in Minnesota, Iowa, and Missouri where no projects are of sufficient importance to be considered. In Arkansas, Louisiana, and along the Gulf Coast in Texas, in lands of approximately 40 inches of precipitation, irrigation is applied mainly in rice growing, which requires level land, terracing, flooding of fields, and therefore more water than nature provides. In all of the remaining western states aridity results in the need for irrigation, at least in some parts, if man is to produce abundantly from the lands.

Of the 11 Western States, generally considered to be the West, only about 2.75 per cent of the area is irrigated, and this amount represents almost one-half the total acreage capable of irrigation. This fact is all the more remarkable when, as has been stated, the entire West is considered to be over two-thirds arid and semiarid. Some areas are bare rock and steep slopes, some have alkaline soils, and many are far from available water so as to make irrigation not economically feasible. It has been estimated that projects could be developed to irrigate 22,120,000 acres in states west of the 100th meridian, in addition to the 20,395,000 acres already under irrigation.

In general, through the past century, the irrigable lands have been overestimated. There has been a constant revision downward of the amount. Furthermore, a large portion of lands now irrigated need more water on them to bring them to higher possible production. At the same time, it is also true in some areas that there is a great need for a more effective use of water now available.

The Beginning of Irrigation. The methods and practices used in the irrigated lands of the West are largely United States' own. In a crude way, irrigation has been practiced for centuries in all the ancient countries: Egypt, Assyria, Babylon, Persia, India, China, Greece, and Italy. In the arid southwest, the Spaniards in the sixteenth century found the more progressive Indians with canals and ditches for distributing the water over their patches of corn. People of the United States received little knowledge of irrigation practices from any of these sources.

At first the devices used in the West to get water on the land were very simple. The Mormons, near Great Salt Lake, were the first whites in English-America to attempt irrigation. In 1847 or 1848 they diverted the water from small streams of the alluvial fans on the western slopes of the Wasatch Mountains. Only simple dams were needed. Nearly all the irrigation in the West was as simple as this. Experience gave confidence, and larger projects were undertaken and completed successfully. The large, costly projects undertaken by the Reclamation Service of the United States find their equal from an engineering standpoint in the work of the British engineers in Egypt and India.

Sources of Irrigation Water. In general, there are two sources of water for irrigation—streams or lakes, and wells. Only about 13 per cent comes from wells, thus leaving streams and lakes the major sources by far. In the 17 Western States, plus Arkansas and Louisiana, there were approximately 70,000 pumped wells used in irrigation in 1950. Out of this number California accounted for about 50,000, the greater part of which were in the Great Central Valley. In a few places "natural irrigation" is effective on piedmonts and lower slopes by seepage from uplands (Fig. 164).

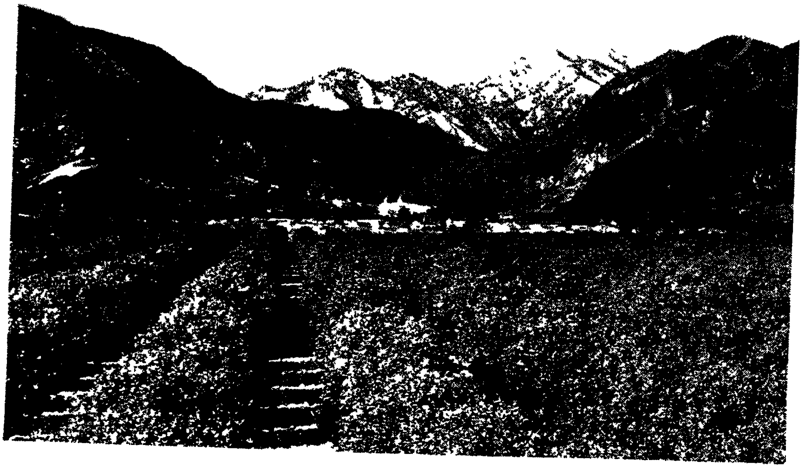


Fig. 164. Natural irrigation at the base of the Sierra Madre Mountains in southern California. For this orange grove considerable water is supplied by seepage from the mountains in the background. *Courtesy, California Fruit Growers Exchange.*

Man has adapted gravity flow for perhaps nearly 70 per cent of all projects, though this figure is only approximate. In many projects, water is lifted from streams to reservoirs, and gravity flow is used thereafter. The most common engineering device is the diversion dam on streams with canals leading away from the pond or lake thus made above the dam. The small project has been most common, but with increases in engineering skills there is a growing tendency towards the large project, involving a great dam or dams, canals that are long and sometimes con-

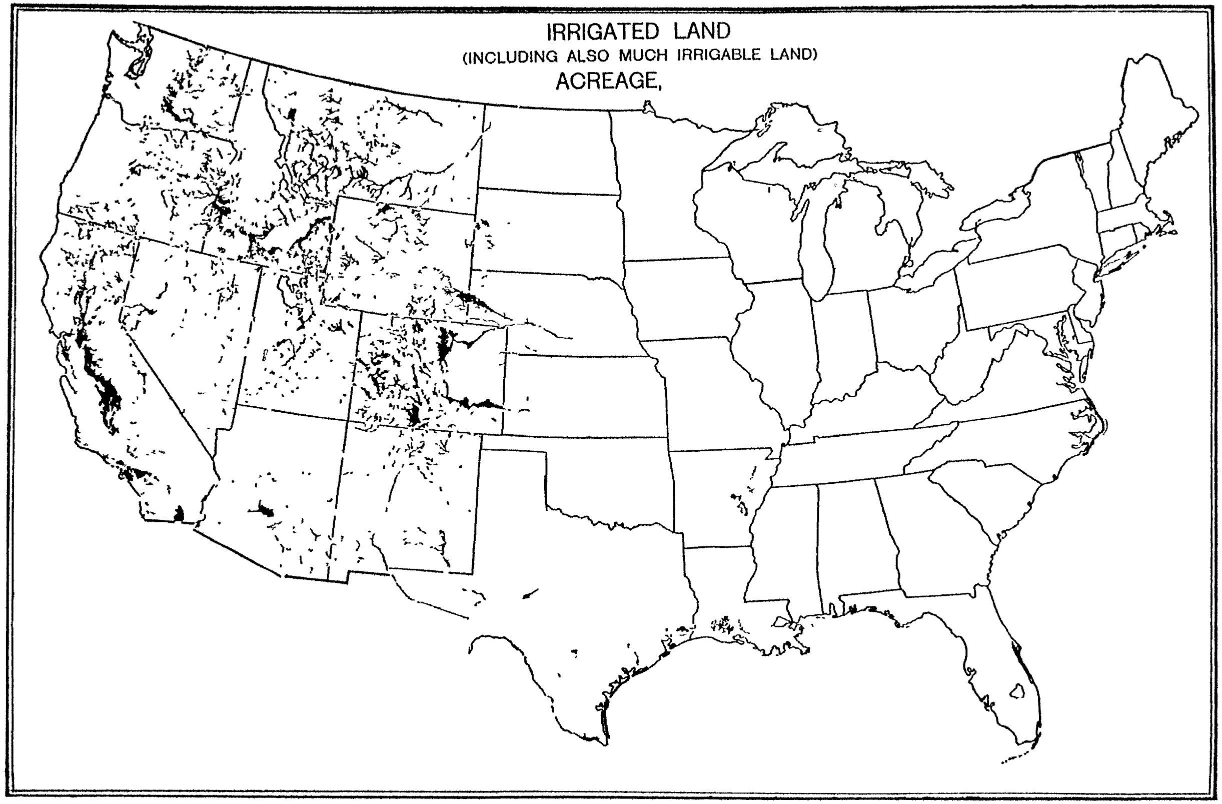


Fig. 165. The irrigated lands east of the 20-inch isohyet are used to grow rice. Discuss the distribution of the irrigated lands in their relation to mountain areas and rivers.

crete lined to prevent seepage, or covered tunnels or tubes to prevent loss by evaporation. Since 1930 the development is frequently "multiple purpose"—aimed at providing for irrigation and also water power, transportation, flood control, and land and forest conservation by preventing rapid run-off and erosion from source areas. There is much to be said in favor of the multiple-purpose project, discussed later.

Extent of Engineering Works. Although irrigation in the West is still young, the amount of work that has been done to develop the enterprises now in operation, when taken in the aggregate, is tremendous. In 1940 the main canals measured more than 127,000 miles, and the pipe lines connected therewith 28,500 miles. More than 7700 reservoirs had been provided, besides 78,000 pumping plants. There were 34,000 diversion dams and nearly 4600 storage dams. The total capital invested amounted to over a billion dollars. Since 1940 and the stimulus of World War II the development of large projects has increased the figures given above, and when considered together with projects completed and approved since 1940 the costs represent many billions of dollars.

Water a Factor in Distribution. The distribution of the irrigated areas is very irregular over the West and bears a definite relation to the supply of water. In general, it may be said that most of the irrigated areas are in the valleys of the rivers that take their rise in the great mountain areas. This pattern is broken only a little where irrigation is from wells, as in west Texas, the Great Plains, and in southern California and the Central Valley of California (Fig. 165).

Nearly all the irrigated lands of Washington (except that now being developed on the Great Bend, from the Columbia), derive their waters from the rivers that flow down the east slope (rainshadow) of the Cascade Mountains. The Columbia, one of the great rivers of North America, with its large flow, has been little used for irrigation up to the present time, if one excludes its large tributary, the Snake River. However, with the completion of Grand Coulee Dam and Franklin D. Roosevelt Lake, irrigation is beginning to be applied to parts of the Big Bend area. The Snake River, the largest tributary of the Columbia, is one of the most important streams of the West in irrigation. Both the Sacramento and the San Joaquin get most of their water from the Sierra Nevada. Little use has been made of the rainfall of the Coast Range for irrigation purposes, for in Washington, Oregon, and northern California agriculture is possible without the artificial application of water. South of San Francisco Bay, all the way to Mexico, the rain is torrential in its fall. However, irrigation is practiced in the Salinas, the Sisquoc, and in several others of the small valleys that outlet to the Pacific.

The Rocky Mountain region is by far the chief source of the water used in irrigation in the West. The Snake, the Green, the Bear, the many short streams of the Wasatch, the Grand, and the Gunnison, and other rivers tributary to the Colorado all have their sources on the western slope of the Rockies. On the eastern slope of the Rockies are many important rivers. In Montana, the main stream of the Missouri, and a score or more of smaller tributaries, besides the large Yellowstone and the Big Horn, supply water to large areas. Most of the land irrigated is in the river valleys and, therefore, does not occur in large blocks but has a linear distribution along the stream courses. The North Platte in Wyoming and the South Platte in Colorado, with all the tributaries of the Platte, furnish water to more than 2,300,000 acres. The Arkansas, farther south, gets its water from the highest parts of the Southern Rockies and irrigates 750,000 acres, mainly in Colorado. The Rio Grande is another Rocky Mountain river that irrigates land all along its course, even on its flood plain near the Gulf of Mexico. The only streams of importance, supplying irrigated lands, that do not rise in the Coast Range, Sierra Nevada-Cascade Mountains, or the Rockies are the Gila River in Arizona and the Humboldt in Nevada. The four most important rivers in the West are the Snake River irrigating 3,819,000 acres, the Colorado, 2,638,000 acres, the Platte, 2,315,000 acres and the San Joaquin, 2,405,000 acres. California, with an irrigated area of 5,069,000 acres, Colorado, with 3,220,000, and Idaho, with 2,277,000, are the leading states, chiefly because of the proximity of great mountain areas that have a heavy rainfall.

Organization of Irrigation Enterprises. The greatest number of irrigation enterprises in the West are organized on an Individual or Partnership basis, consisting of individual farmers and neighbors who use small works employing gravity diversion from rivers, or sometimes water from wells, without a formal organization. In 1950, approximately 34 per cent of the irrigated lands of the West were under this type of sponsorship.

A second type of organization is the Cooperative or Mutual Enterprise, accounting for 31.5 per cent of the irrigated area. In this type, water is distributed according to the ownership of stock in the corporation. Still another type of organization is the Irrigation District, a public corporation established under state laws, which give the inhabitants of the district the power to obtain funds, build irrigation works, and perform other corporate duties. It applies to 16.5 per cent of the irrigated lands.

The commercial enterprise supplies water to farmers who have no financial interest in the works. It is a business which sells water privileges at a profit, and applies to about 7 per cent of irrigated lands. It is declining in importance. The Bureau of Indian Affairs projects are government built and operated solely for Indian reservations. They constitute 2.5 per cent of the irrigated lands.

The last type is the United States Bureau of Reclamation project, which resulted from laws passed in 1902. The type applies to large developments, most frequently multiple purpose, as stated before, and is supported by public funds as well as by taxing the beneficiaries. It is a long-range plan, and, as a type, it is increasing in importance, accounting for about 8.5 per cent of all irrigated lands in 1950 (Fig. 166).

Crops on Irrigated Lands. In nearly all irrigated lands of the West, alfalfa and perhaps some small grains are grown, largely for local use. Wherever dairying or cattle fattening is practiced in irrigated areas, or on lands closely associated with irrigation, as in Utah and Central California, alfalfa is an important stock food. This hay crop serves also as a soil-building crop because of its high nitrogen value. The West produced more than one-third of the alfalfa hay crop of the country in 1950, and more than one-half of the alfalfa seed. Utah and Arizona led all states in alfalfa seed production, nearly all of which came from irrigated lands.

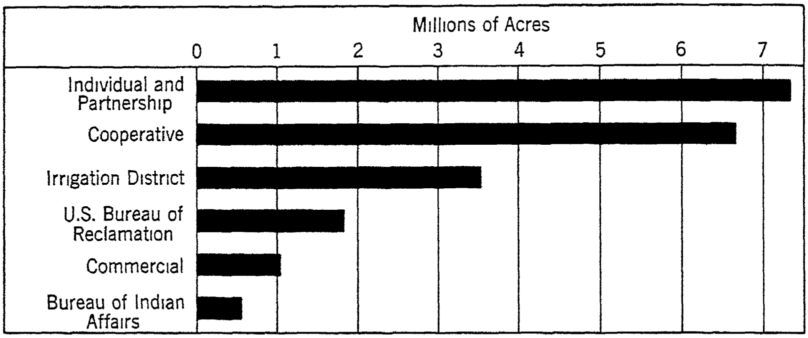
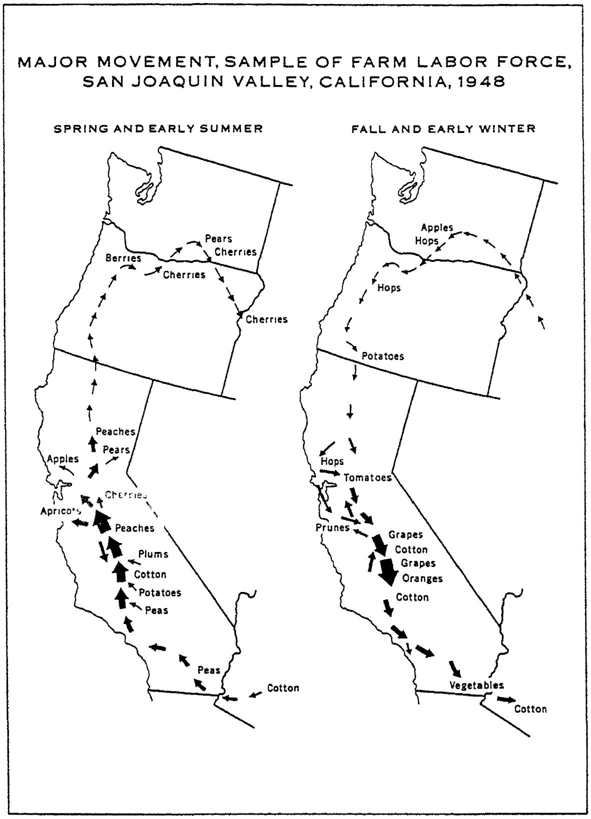


Fig 166. Irrigation by types of enterprise The acreage of the irrigated lands in the Federal Reclamation projects, contrary to general opinion, is but a small part of the total irrigated acreage of the West.

In general throughout the West, alfalfa, sugar beets, and cotton play an important part as combination crops in irrigated farm economy because of the feed value for livestock—mainly cattle, discussed in the following chapter. All of them are crops applicable for intensive agriculture on irrigated lands where water is costly. Cotton is confined to the southern parts of the West where seasons are long, sugar beets are confined to the central, western, and northern portions where the seasons are shorter and temperatures are not so high, but alfalfa is widely grown throughout most irrigated areas.

Truck crops play an important part in the production of most irrigated lands, because they demand intensive cultivation. They supply the home market for most areas, but frequently a specialty is made of one or more crops, where by canning, refrigeration, advertising, scientific packing, and good transportation a crop may reach the wider markets of the country. Thus, potatoes from the Pocatello Idaho region and canned peas from the Blue Mountains irrigated areas in Washington and Oregon reach the larger market outside the West. Other important crops that reach the larger markets are tomatoes, beans, cauliflower, asparagus,



U. S. DEPARTMENT OF AGRICULTURE BUREAU OF AGRICULTURAL ECONOMICS

Fig. 167. Farm-labor movement by seasons on the West Coast, San Joachin Valley, California, 1948. The labor supply becomes an important factor in harvesting fruit and other crops in the West Coast states The differences in seasonal requirements for various crops result in a northward movement of labor in spring and early summer, and a return movement in fall and early winter. The demand for labor is particularly heavy in the San Joaquin Valley. Mexicans and many others from the South make up the large part of this transient labor force. *Courtesy, U. S. Bureau of Agricultural Economics.*

carrots, lettuce, celery, and artichokes. California is by far the leading state in the crops named, and it supplies the bulk of the early truck crop of the United States.

In all agriculture of the West irrigated crops are far more important than crops not irrigated. In total value among irrigated crops the fruits take front rank. In fruit and vegetable harvesting in the West the labor problems become acute at times (Fig. 167).

So much is said and written about Western fruit growing, and the Western cooperative associations advertise so freely, that it may be well to consider a summary of the fruit industry of the West in comparison with that of the country at large. This summary is shown in Table XII.

TABLE XII

A SUMMARY OF FRUIT PRODUCTION IN THE WEST IN 1950

Fruit Crops	Production	Percentage of Product of United States
Apple	48,061,000 bushels	26
Grape	2,458,800 tons	90
Orange	44,800,000 boxes	39
Peach	31,557,000 bushels	59
Plum and prune	412,500 tons	98
Lemon	13,000,000 boxes	99+
Apricot	215,000 tons	99+
Pear	25,864,000 bushels	82
Sweet cherry	68,000 tons	83
Strawberry	3,900,000 crates	35

U. S. Census, 1950.

The Lack of Markets and Solution of Problem. The greatest drawback to western farming is the lack of markets or the long distance to markets. The coastal states, where the largest cities are located, have better markets than Utah, Idaho, Arizona, and New Mexico. The great market for any of the money crops is the densely settled portion of the United States.[1]

Since about 1920, cooperative associations and exchanges in the West have striven to develop the markets of the eastern states for some of their products. They have succeeded in giving the public a reliable product of uniform grade, tastefully and carefully packed. The work of these agencies is diverse. They secure capital and credit, adapt production to market demands, establish grades and standards for the products, provide cold-storage facilities, select brands and trade marks, advertise, develop old and extend new markets, secure favorable freight rates, utilize by-products, eliminate waste, and purchase supplies. The perishable nature of the products they handle, the great distance to market, the strong competition offered by areas nearer the great markets of the country, and the small land units controlled by the individual producer have brought the associations into existence. The marvelous success of western fruit in capturing and holding eastern markets is due largely to the admirable work of these cooperative associations. Perhaps in no place in the world have cooperatives been as well developed and more influential than those associated with fruit growing in the West. The large returns and the stability of the market have brought prosperity and satisfaction to the producers.

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[1] In railroad rates the coastal district has an advantage over interior sections on some commodities, the rate for goods between New York and San Francisco being lower than between Salt Lake City and New York.

Relative Success of Irrigation. How successful is irrigation agriculture in comparison with agriculture in the humid sections of our country? Official statistics are not available that will enable one to draw definite conclusions. Many enterprises have been highly successful as measured in dollars and cents, and still more so in terms of social and individual betterment. Others have been miserable failures. Some irrigation developments were, and are, poorly located; the supply of water is inadequate or the low temperatures and the short growing season restrict the variety of crops. On some projects extensive crops are grown, but the high cost of water makes only intensive agriculture profitable. Contacts with markets are inadequate. Marketing associations are not well developed or do not function adequately. The irrigation farmers lack the techniques essential to success. Lands have been reduced in yield or damaged beyond recovery by excessive flooding or improper drainage. The cost of water on some projects is very high, and much is lost by seepage. On only a few projects has all the land that the irrigation works are capable of irrigating been taken up. In 1950 the works were capable of irrigating considerably more than 31,000,000 acres, but less than 25,000,000 were actively irrigated.

Since the cost of the irrigation works is supposed to be spread over the whole acreage, either the water consumers or the "enterprise" that built the irrigation works must absorb the sums apportioned to the 5,000,000 or more acres. This adds to the already heavy cost of water to the farmer and reduces the returns to the enterprise that provided the irrigation works. On the whole, the yield to the acre of irrigated land is but little more than on non-irrigated, humid lands, and, as a rule, the investment, maintenance, and cost of operation to the acre are greater.

When the irrigation movement was young, real estate dealers in irrigated lands and irrigation enthusiasts led people to believe that the ownership of a parcel of irrigated land in the West was a surcease of all earthly cares and ceaseless toil. Soil with an abundance of soluble matter, bright cloudless skies which favored photosynthesis, and a supply of water responsive to man's will—what more could one desire! But people have long since realized that on most projects in the West success has not been so great as was anticipated. Success requires even greater intelligence and enterprise and harder work on irrigated farms in the West than it does in the humid sections of our country.

The Bureau of Reclamation projects insofar as irrigation is concerned have been costly, but it must be kept in mind that only about 9 per cent of irrigated land in the West is under this type of organization. About two-thirds of all irrigated lands are Individual, Partnership, or Cooperatively organized, and in these irrigation is generally considered to be successful. They are the oldest in irrigation and they occupy generally the best sites. Also they are not multiple-purpose to the extent that is true of the Bureau of Reclamation projects. In many cases, farmers using irrigation on Bureau projects have not and could not pay the costs allocated for water use.

It is claimed by many that such heavy subsidizing of agriculture on government projects is wholly unfair to the irrigation farmers who by their own enterprise and funds have had to provide their own lands and irrigation works.

Whatever the injustices may be resulting from the management of some irrigation projects, or whatever may be the failures of some projects, and without any attempt to say what should have been done, one must evaluate the entire process of irrigation from the standpoint of the benefits to the people as a whole. This will involve a consideration of other possible benefits frequently associated with irrigation projects, such as water power, harbor and navigation improvements, flood control and domestic water supplies.

IMPORTANT IRRIGATED AREAS

In a treatise of this nature it will be impossible to describe all the hundreds of irrigation projects, large and small, in the West, but an attempt is made in the following paragraphs to discuss briefly a few of the important ones. They are (1) the Salt River Valley, (2) the Colorado Delta, (3) the Río Grande, (4) the Colorado-Big Thompson project, (5) the Uncompahgre project, (6) the Salt Lake Oasis, (7) the Snake River projects, (8) The Apple Valleys of the Columbia Basin, (9) the Nevada projects, (10) the Los Angeles Area, and (11) The Great Valley of California (Fig. 168).

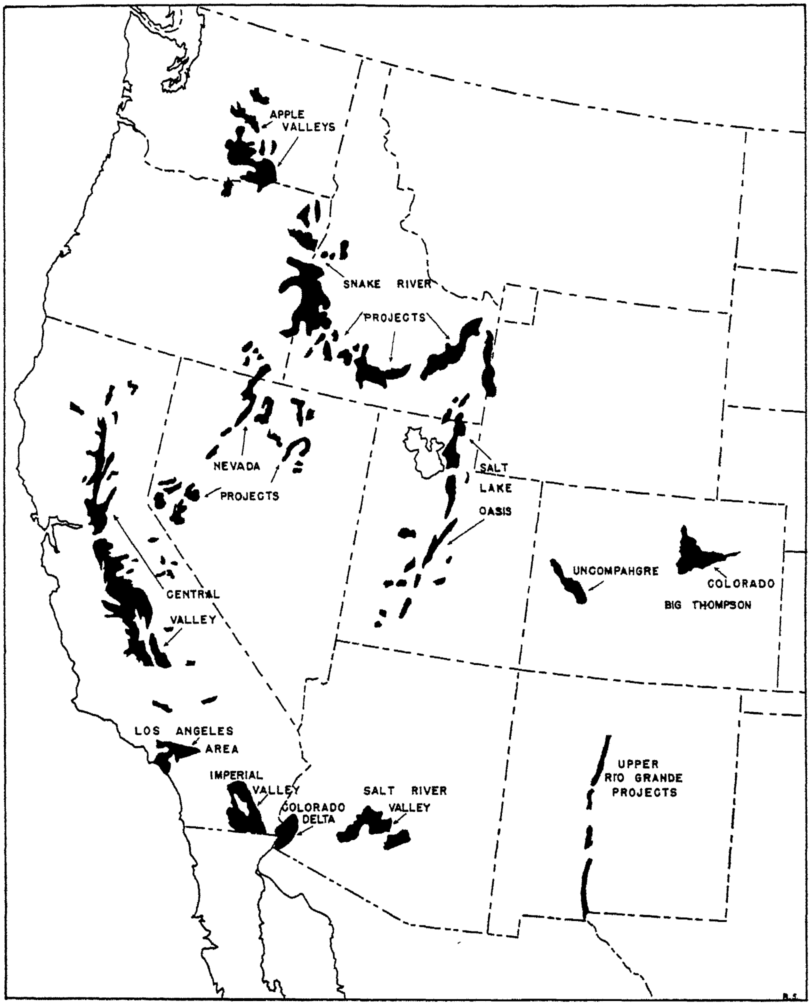


Fig. 168. Irrigation projects and areas in the West. This map is intended to show locations of representative irrigation areas discussed in the text. There are numerous other very important projects on the upper Missouri, the Platte, the Arkansas and elsewhere in the West.

The Salt River Valley. This project is located to the north of Phoenix, Arizona, on the Salt River, a tributary of the Gila. Here about 225,000 acres receive water from Roosevelt Lake impounded behind the large Roosevelt Dam. This is one of the first of the Bureau of Reclamation projects, and it was completed in 1911 at a cost of $3,890,000. So large is Roosevelt Lake that it is said to contain a 2-year supply of water for the project, if no rain were to fall during the period. A pumping system keeps the soil from becoming waterlogged, a condition which handicapped Indian irrigation agriculture in this same place, long before white man. At first the area grew alfalfa and supported a dairy industry, but Egyptian cotton came in as a result of the stimulus of high prices during World War I, and dairying declined. The growing season is long so that some crops are produced in every month. Four or five cuttings of alfalfa are made in a year, and this crop still occupies about 50 per cent of the acreage. Decline in prices of cotton have hindered the more extensive development of this crop, but it is still important. Citrus fruits, figs, and melons are also grown. The location gives the region a slight handicap in market over the California-grown produce of like nature.

This project as a whole has been considered very successful, though the amount of silt brought into the lake at present is sufficient to fill it in about 2 centuries. There is great need for erosion control in the drainage area above Roosevelt Lake.

The Colorado Delta. This region has an interesting physical history. The head of the Gulf of California is filled with the deposits of the Colorado River, one of the highest silt-laden streams in the United States. The filling in of the gulf has resulted in cutting off the northern end, where high evaporation and low rainfall have created Salton Sea, now about 270 square miles in area, with a surface of 248 feet below sea level. The Colorado River has extended itself across the deltaic deposits to reach the gulf, no doubt having changed the position of its channel many times, sometimes filling the Salton Sea to a high level and at other times leaving it to evaporate to a low level.

To complicate man's use of this delta by irrigation, for it is a land of less than 10 inches of precipitation, is the fact that the boundary between California and Arizona cuts through it, as well as the international boundary between Mexico and the United States. The question of water rights has arisen, for the volume of the river varies greatly between flood stage and times of low water, and the amount of sediment carried is very great. The building of dikes to control the water has been a problem.

The Bureau of Reclamation created the Yuma project on the Arizona side of the delta and the Imperial Valley on the California side. These contain about 50,000 and 800,000 acres, respectively. The natural and most economical route for a canal to lead Colorado River waters to Imperial Valley was through Mexican territory, but this raised some international problems; therefore a rather expensive "All American" canal was constructed, paralleling the national boundary but entirely on United States territory. This canal feeds the Imperial Valley to the southeast of Salton Sea, and the Coachella branch leads to the east and north of this sea. Some lifting of the water is necessary, but great use is made of gravity flow.

These projects have over 300 frost-free days per year and hence are suited for tropical-subtropical crops. The citrus fruits, figs, dates, vegetables, melons, long-fiber cotton, and alfalfa are all important. Iceberg lettuce is a specialty in the Imperial Valley, and this product reaches the market throughout the United States. Range cattle and some sheep are brought to be fattened on alfalfa and then marketed mainly in the Los Angeles area. The rich, deep alluvial soils have caused the Colorado delta to be referred to as "The American Egypt."

The Rio Grande Project. Although the Rio Grande supplies water for numerous irrigation projects along its course, serious difficulties have arisen in the development and operation of them. This stream has its main source in the Rocky Mountains of southern Colorado and northern New Mexico, flowing southward across New Mexico; then it turns generally southeastward at El Paso and reaches to the Gulf of Mexico. For the long stretch below El Paso it forms the Texas-Mexican boundary. The stream is long, it flows through semiarid country, it carries much sediment, and it is subject to floods and low-water stages.

Indians had used the upper Rio Grande waters for irrigation in pre-Columbian times, and Mexicans developed some projects even before 1800, mainly opposite El Paso and downstream a short distance. Early diversion of Rio Grande waters in New Mexico before 1910 resulted in insufficient supply for the Mexican projects below, and that country threatened to bring suit for damages. The outcome was that the Reclamation Bureau of the United States built Elephant Butte Dam at Hot Spring, New Mexico, about 120 miles above El Paso, in 1916. It impounds a great amount of water in Elephant Butte Reservoir, capable of regulating the flow, supplying nearly 200,000 acres in New Mexico with irrigation water, and guaranteeing 60,000 acre-feet of water a year for Mexican irrigation just below El Paso.

Today the irrigated area along the Rio Grande in New Mexico between Elephant Butte and El Paso is one of the garden spots of the Southwest. It contains many villages and numerous diversion canals. The growing season here is long, and, though some alfalfa and fruit are grown, the major crop is long-staple cotton. Mexican labor is used to a considerable extent.

Space does not permit a description of many other irrigated areas along the Rio Grande, but the Elephant Butte project is one of the most important of them. It was built to settle a question of floods and water rights with a neighboring country, but this difficulty may arise again for it is reported that the Elephant Butte Reservoir is filling with sediment very rapidly. When this occurs floods again will harass El Paso and the Mexican border adjacent, and at low stages there will not be enough water for the Mexican irrigation. This project is an excellent example of the necessity for regional planning, whereby methods of erosion control could have been practiced in the source areas above the reservoir. The long-distance future of the Elephant Butte Project does not appear bright.

The Colorado-Big Thompson Project. The largest irrigated area on the Great Plains is the Colorado-Big Thompson project. It lies on the Rocky Mountain Piedmont, generally in the source area of the South Platte River, north of Denver. It includes the lands of the Greeley Colony which was founded there in 1870. There was a great shortage of water in the area in the 1930's, which led the Bureau of Reclamation to construct the project. Construction began in 1938, the first power was developed in 1943 ,and water for irrigation was provided soon after.

This project is somewhat unique, though several smaller ones of like nature had preceded it. It lies entirely to the east of the Rocky Mountains, yet it takes water from the Grand Reservoir and other reservoirs to the west of the divide, through a 13.1-mile tunnel 9.5 feet in diameter and capable of carrying 550 second-feet of water. A considerable amount of water power is developed. The original plan of the Bureau was that one-half the cost was to be repaid from hydroelectric power, and the other half, not to exceed $25,000,000, was to come from the users of water, organized as the Northern Colorado Water Conservancy District. Numerous reservoirs in the mountains, but mainly Grand Lake, provide for storage and thus conserve and regulate the flow of the upper Colorado River from which this water is taken.

This project has not worked out to the complete satisfaction of the water users of the area. It provides only water supplemental to what was available before, and it has been found that very little if any, new lands have been added. The cost of the project has reached over twice the original estimate, and it was not yet completed in 1952. It is claimed that the water users cannot and will not pay. Advocates who favor the work of the Bureau, however, point to the great advantages derived from hydroelectric power, as well as the indirect benefits of the project to public welfare in regulation of stream flow, soil conservation, flood control, forestry, wild life, etc. It should be noted that this supplemental supply of water would be sufficient to prevent a severe water shortage in the region, such as that experienced in the 1930's when losses were estimated to have reached $5,000,000 annually for each of several years in the decade.

The elevation of the irrigated area is between 3500 and 5400 feet, it has about 15 inches of rainfall (great annual variability), from 4 to 5 months only for growing season, and an average mean temperature of 48°. Obviously this is not a subtropical land. The chief crops are sugar beets, potatoes, beans, corn, small grain, fruits, alfalfa, vegetables, dairy products, poultry, and eggs. Hogs, cattle, and lambs are fattened on alfalfa and the by-products of sugar beets. Denver is the chief market.

This project is largely responsible for Colorado's high rank among the states in the production of sugar beets, potatoes, and beans. In 1951, Colorado ranked second in sugar beets, eighth in potatoes, and fourth in dry edible beans.

The Uncompahgre Project. In earlier days, many small irrigation projects were developed within the Rocky Mountain region to supply produce largely for mining towns. These were mostly private or state-developed projects, but since the first decade of the twentieth century the United States Bureau of Reclamation has developed several areas within the Rocky Mountains, one of the important ones being the Uncompahgre project in southwestern Colorado. In this area, the Gunnison and Uncompahgre Rivers flow westward and northward from the mountains of central and southern Colorado to join the Colorado River. The Gunnison is the larger of the two tributaries, and carries a considerable volume of water, but there are no lands adjacent suitable for irrigation. The smaller Uncompahgre, at one place only a few miles away, has a low volume of water, but it does have about 200,000 acres of broad flat lands bordering it, suitable for irrigation. This project involved the diverting of waters from the Gunnison River to the Uncompahgre by a tunnel 6 miles long, and the building of Taylor Park Reservoir in the source waters of the Gunnison Valley, as a regulator of flow. The Bureau completed the project in the first decade of the twentieth century, at which time the Uncompahgre Valley Water Users Association agreed to repay construction costs in forty annual installments.

The Uncompahgre Valley is considered a successful irrigation project, and it is a garden spot of southwestern Colorado. It is served by United States Highway 50, and by the Denver Rio Grande Railway. It has an annual rainfall of only 9.5 inches, an average growing season of 175 days, and a mean temperature of about 50° F. The season is not long enough for cotton or subtropical fruits, but it specializes in onions, sugar beets, and potatoes, along with the seemingly indispensable alfalfa, beans, and the small grains.

The Salt Lake Oasis. Lying to the east and south of Great Salt Lake, Utah, are a number of non-contiguous irrigated areas referred to collectively as the Valley of Great Salt Lake or the Salt Lake Oasis. They contain more than 1,000,000 acres, and constitute the heart of the state of Utah, with two-thirds of the population of the state.

The particular physical conditions here are the high Wasatch Mountains trending north-south, the heavy rainfall and snow-capped western slopes, the broad Piedmont on the west side of the mountains, and the numerous westward-flowing streams from the mountains across the Piedmont, which lose themselves in the arid basin beyond. The conditions were ideal for numerous small projects where stream diversion was easily accomplished on the Piedmont, either as private or commercial projects. These were the first irrigated lands of the West, and the general nature of the place fit in well with the communal living of the followers of the Mormon Church. It was to this region that Brigham Young led the Mormons, well before the California Gold Rush and the coming of numerous other whites into the West.

The Mormon population grew rapidly in this oasis, and the irrigable land was settled rapidly. There has been no great extension of irrigation since before the Civil War, but methods of diverting and using water have been much improved. The people live mostly in villages and travel out to the croplands, which are generally small holdings farmed intensively. Invariably villages are located on streams where water may be made available: they may be but a few miles apart along a stream, but in traveling north-south one often crosses desert stretches between villages. Sugar beets, grains, alfalfa, and fruits and vegetables are grown. Near Utah Lake and Great Salt Lake the soil is often waterlogged and too alkaline for cropping, but much is used as grazing land. On adjoining lands, not irrigated, considerable wheat is grown by dry-farming methods (discussed later), but this is only to supplement irrigation farms. One seldom sees farmsteads on the adjacent arid wheat lands.

The Snake River Projects. The Snake River, a tributary of the Columbia, rises in the high Rockies of western Montana and flows generally westward and northward, making a long southward bend through Idaho, and, after forming the boundary between Oregon and Idaho, it joins the Columbia in southeastern Washington. Through southern Idaho the Snake has numerous tributaries and wide areas of land suitable for irrigation. Projects are developed all along the Snake River so that it is sometimes said that the Snake is the most thoroughly used for irrigation of any of the large streams of the West. The state of Idaho has over 2,000,000 acres under irrigation, and a large part of these are in the Snake River Valley. As the Salt Lake Valley is the heart of Utah, the Snake River Valley is the heart of Idaho. Here live more than one-half the people of the state, here are grown most of the crops, and here lies a large part of the wealth of the state.

Fruit is important in the west end of this valley, but throughout the main crops are alfalfa, beans, potatoes, and wheat. Dairying is important, and sheep are grazed on nearby National Forests in summer and fattened on irrigation farms in winter. The Idaho potato famed as being a "baking potato" comes largely from the Pocatello area of the Snake Valley.

The Apple Valleys of the Columbia Basin. A series of small rivers on the eastern rainshadow slope of the Cascade Mountains drain to the Columbia River. They flow through a land where the rainfall is too low for agriculture, but they have considerable volume because they rise in the high Cascades to the west. Not a great amount of level land is available for irrigation except narrow strips along the rivers, but these valleys constitute a world-famous apple-growing area—the Yakima, Wenatchee, Chelan, Okanogan, Hood River, and Deschutes Valleys.

Irrigation works are arranged to impound waters and distribute them largely by gravity flow (Fig. 169). The frost-free season is nearly 200 days, and rarely do freezes occur to injure orchards. However, positions on slopes are selected for orchards in order to take advantage of air drainage. The high percentage of sunshine is said to give the fruit an attractive color.

In 1951 the state of Washington produced 35,500,000 bushels of apples, and thus accounted for more than one-fourth of the total crop of the United States.

The Nevada Projects. In Nevada, a Great Basin state, aridity prevails throughout. A large portion of the state has an average annual precipitation of less than 10 inches, yet there are several small streams which rise in the Sierras and other mountains generally draining into the state to lose themselves in the salt and alkali flats of the interior. Small irrigation projects are developed along these streams to total perhaps less than 1 per cent of the area of the state. Otherwise Nevada is desert or sparse grazing land.

The important streams that furnish irrigation waters are the Truckee, Walker, Carson, and Humboldt. Some of these become important because they lie on the main route of travel across the state, and thus have a market at home for alfalfa, dairy products, wheat, and vegetables, which are the main crops.

The Los Angeles Area. To the east and southeast of the city of Los Angeles for a distance of 40 or 50 miles is an irrigated area of more than 300,000 acres, which has become one of the best known in the West. The Santa Ana and San Gabriel Rivers rise respectively in the San Bernardino and San Gabriel Ranges to the north and course southward and southwestward to the Pacific Ocean. These rivers have in the past brought great amounts of sediment from the ranges to fill in a large area at the foothills, and to pass through a low upland of sand hills to spread their sediments farther on a broad coastal plain bordering the Pacific Ocean. The rainfall is under 20 inches but is much greater in the mountains, and it comes mostly in the winter months. The frost-free season is approximately 240 days, the percentage of sunshine is high, and thus the rate of evaporation is high.

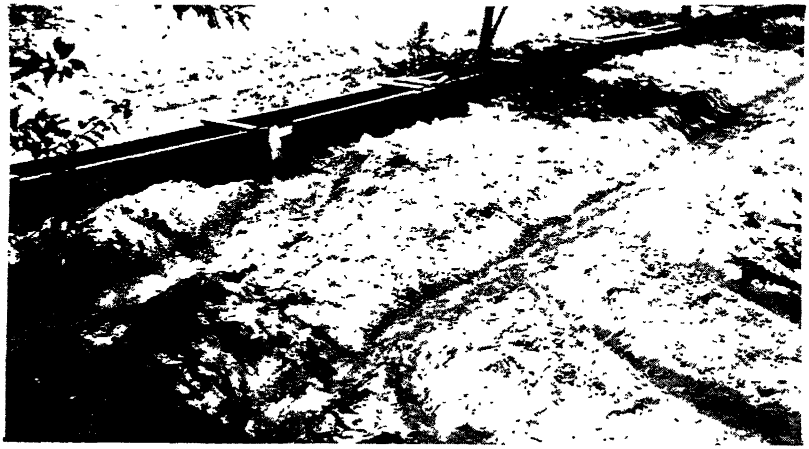


Fig. 169. Method of irrigation from waters of Mt. Hood, in Hood River Valley, Oregon. A wooden flume is used to carry the water, and further diversion by gravity is accomplished by small trenches ingenuously arranged.

Irrigation began as early as 1851 in the San Gabriel district and spread to Riverside and San Bernardino districts in the 1870's. At first the raisin grapes were grown, but, with the coming of transportation facilities, oranges and lemons were introduced, and it was found that the climate was suitable for them. Today a large part of the orange crop of California comes from this area, which also produces about 99 per cent of the lemon crop of the United States (Fig. 170). Peaches, apricots, olives, and the Japanese persimmon are also grown. This area leads the country in the production of English walnuts, and some almonds are grown, but the bulk of this crop comes from the coastal valleys of Central California. A somewhat recent new crop is the avocado, part of which reaches the market under the trade name of "Calavos."

Nearly three-fourths of the water for irrigation is obtained from wells, some flowing but mostly pumped, for here the deep gravel deposits form a natural reservoir. With much use the ground water has lowered so that now some diversion canal systems supply water from the San Bernardino Ranges. Maximum development had about been reached before Colorado River water reached the area in the 1940's.

The Great Valley of California. Lying in the central part of the state of California and extending north-south is a troughlike depression 50 miles wide and 400 miles long known as the Great Valley of California. It is bordered on the east by the high Sierra Nevada mountains and on the west by the lower Coast Ranges. These mountains are the fault-block type; their gentle slopes are towards the west, and fairly steep slopes face east. The Coast Ranges, in general, reach from 2000 feet to 4000 feet above the sea, whereas the Sierras are from 8000 feet to 12,000 feet above the sea. Moisture-bearing winds from the Pacific Ocean bring rainfall on the west slopes of these ranges. It is particularly heavy on the long gentle west slope of the high Sierras, and light in the Great Valley. Ages of erosion have resulted in a filling of the Great Valley with alluvium several hundreds of feet in depth. Streams on the west slope of the Sierras have cut deep canyons and formed coalescing alluvial fans in the trough.

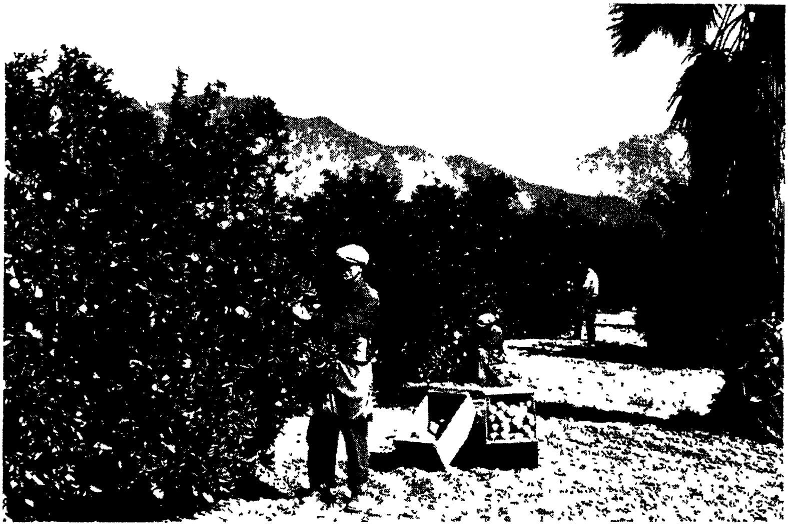


Fig. 170. Picking oranges in Orange County, California. Notice the coarse gravel soils, representing thousands of years of erosion from the more rainy mountains in the background.

The Coast Ranges are broken by the sunken area which forms San Francisco Bay, and thus the drainage outlet of the Great Valley. The Sacramento River drains the trough from the north, and the San Joaquin from the south. They join just before they reach the Bay. At the south end of the Great Valley there exists an area of interior drainage, due to its separation from the trough by the large alluvial fan of Kings River, and the arid climate.

The mediterranean subtropical climate prevails throughout most of the Great Valley, which has hot summers and mild winters, with most of the rainfall in the winter wonths. The growing season is long, though frosts are experienced at times. The rainfall in the Valley is as low as 5 inches annually at the southern end, but it is 25 inches at the north. Originally a great supply of ground water existed throughout the valley because of the seepage into the alluvium from the streams on the Sierra west slope.

Because of the low rainfall the Great Valley was originally a grass land. The grasses were tall with scattered oaks in the more moist northern part, but the dry southern part was bunchgrass and desert vegetation.

There are few regions in the United States that illustrate "sequent occupance" of the land any better than the Great Valley of California. Beginning with Spanish and Mexican ranching, the cattle business grew to occupy most of the southern portion, the Bay area, and even parts of the northern portion of the Valley by the time of the Civil War. The great growth of population with the Gold Rush gave impetus to ranching, for which the valley is ideally suited. After the Civil War, the population became still greater, the transcontinental railway was completed, and cattle ranching gave way to the more intensive land use—wheat farming. Ranching was crowded into the drier sections and on to the more rocky slopes and marsh lands. In the 1870's the Great Valley of California was considered one of the great "bonanza" wheat-growing areas of the country.

In the early 1880's another change in agriculture of the Great Valley began to take place through irrigation applied to fruit and vegetable growing. It was discovered that water could be diverted from the mountain streams and that artesian wells, either flowing or pumped, could be had with relative ease. Thus a change was made from dry-land wheat farming to a still more intensive land use in growing fruits and vegetables. Today the Great Valley is one of the most important fruit and vegetable growing areas of the continent. The value of fruit and truck crops produced in the state annually is far greater than the annual production of minerals. Wheat still occupies a large acreage in the Great Valley, but it is relegated to the dry-land farming areas and the less intensively cultivated lands. It is of minor importance in the farm economy of the Great Valley.

Irrigation is practiced throughout the Great Valley. The projects are very numerous, and irrigated areas are not always contiguous, being interspersed with ranching and dry-land grain farming, particularly in the central and southern parts. However, taken in its entirety, this is the largest region of irrigation in the West. It accounts for about 3,000,000 acres out of the state's total of over 5,000,000 acres "under the ditch." Artesian wells have played a relatively large part in the securing of water in the valley, but there is an increasing necessity for pumping wells, indicating the lowering of the ground water.

Throughout most of the West there has been much trouble over water rights to land owners. The "doctrine of riparian rights" for waters allowed owners of land along streams to maintain the flow of water in those streams in undiminished volume. This doctrine is not suited to a land where irrigation must be practiced. It permits great overflow and waste of water on some worthless land and prohibits man-made ditches and canals from leading water to areas that might use water to a great advntage. In a large part of the West the doctrine of "prior appropriation" has been applied to water rights, that is, "first come, first served." Obviously a strict application of either doctrine would result in a less effective use of water when applied to a region as a whole. There has been much litigation over water rights in the West.

Among the field crops produced by irrigation, rice and alfalfa lead. Rice is grown entirely in the Sacramento Valley where water is plentiful and where the heavy clay soils and natural levels are well suited to its cultivation. California produces about one-fifth of the nation's crop, the remainder coming from the larger producing sections of the Gulf Coast of Texas and Louisiana, and the bottoms in Arkansas.

Alfalfa is grown throughout the Great Valley, where sometimes as many as six cuttings are made annually. Other field crops are sugar beets, dry beans, and cotton. Sugar beets are grown chiefly in the Sacramento and Salinas Valleys. Beans are an important crop in the Salinas Valley, and long-fiber cotton is produced in the southern San Joaquin Valley.

Considerable attention is given to orange groves in the southern San Joaquin Valley, but for the large production of citrus fruits one must look to the Los Angeles basin. Considered from the standpoint of acreage the main fruit crop of the Great Valley is grapes, centered about Fresno. About 90 per cent of the United States grape crop is grown here and it is marketed largely as raisins. Prunes and plums are grown in the Bay area, but the large part of this crop comes from the Santa Clara, Sonoma, and Napa Coastal Valleys. Together they give California over 90 per cent of plums and prunes produced in the United States and 50 per cent of the world crop. Peach production is centered about Merced and Fresno and has since 1930 spread into the lower Sacramento Valley, where the clingstone variety seems to be at its best. Canning of peaches is increasing over drying. Fresno has long been the peach-drying center. Apricots, cherries, figs, and olives are important fruit crops in the central and southern San Joaquin Valley. Pears and apples require the cooler temperatures and are grown in the Bay area and the Sacramento Valley.

The Central Valley of California produces large quantities of vegetables. Many are used locally, but large quantities of potatoes, celery, artichokes, asparagus, beans, peas, and tomatoes are produced in the Delta District about San Francisco Bay, where canning is important, and thus they reach the wider markets to the east.

DRY-LAND FARMING

Dry-land farming, as defined by one of the great authorities, is "the profitable production of useful crops, without irrigation, on lands that receive annually a rainfall of 20 inches or less." Dry-land farming is really farming under drier conditions than exist in humid sections, and it is probably best not to introduce the question of amount of rainfall. Even where the rainfall is 30 inches or more, some farmers increase their yield by careful tillage, and it seems possible that the soil response to careful tillage here is similar to that in semiarid areas. It is impossible to state the area of the West that is dry farmed, for no census data have been collected on this type of farming.

Problems of the Dry-Land Farmer. In humid lands the farmer endeavors to maintain soil fertility by keeping the soil in good physical condition, by maintaining the required amount of essential chemical elements in the soil, and by providing a suitable amount of humus. Only in a minor way does he think of water conservation, and, although the adaptation of varieties of crops to soil moisture is essential for the most profitable farming, the fact that little attention has been given to this adjustment shows that it is not essential to success. In the arid lands the problems confronting the farmer are far greater, for besides the maintenance of soil fertility he has the problem of water conservation, the most critical of all, and also the selection of crops that will grow best with the limited amount of water available. Successful dry-land farming calls for careful, painstaking, intelligent husbandry.

Experiments at the various agricultural experiment stations in the dry-land farming area have demonstrated that a rainfall of 10 inches, if all is saved, will furnish enough water to give yields of wheat and other crops, far above the average of the country.[2] Fortunately for the farmer, nature has provided a natural storage reservoir in the soils of the semiarid land. These soils contain a little clay, as a rule, are porous, granular and, therefore, permeable and deep. Soil and subsoil are practically alike. The water table (if there is one) is so far from the surface that the rain water rarely percolates far enough to reach it. The water that falls as rain forms a sheet of gravitational water in the upper interstices of soil and subsoil and gradually works its way down, becoming capillary water. By becoming capillary water, its downward journey is checked, and if the soil is properly worked a large amount of this capillary water remains within reach of the roots of the plant. This is soon used up if the soil is heavily cropped; frequently a sufficient amount of water may be stored to give fairly good yields of "drought-resisting" plants.

The problem of the farmer is so to work his land that all or nearly all the water that falls will soak into the ground and be retained there for the production of crops only. Formerly the practice was to plow deeply, and keep the upper surface well pulverized, forming a dry mulch to prevent evaporation. With the experiences of disastrous "wind-blows" and soil erosion of the 1930's many farmers are turning to contour plowing and terracing, strip cropping, and stubble listing, and avoid the dry mulch surface where soil blowing might begin. The new methods are advocated widely, but many farmers still cling to the older methods. Fallowing is always necessary where the rainfall is much below 20 inches. In many sections crops are grown only every other year, or the fallowing may extend over 2 years. It has been found that 20 inches or more of rain may easily be stored in the upper horizons of soil and thus be reached by the roots of the plants. Weeds should not be permitted to grow, for they absorb as much moisture as crop plants.

The Problem of Plant Selection. Plant selection is another problem. As a result of many trials and failures in the breeding of new varieties, and by the importation of plants from the semiarid regions of Europe, Asia, and Africa, this problem is being solved. Barley, rye, and some varieties of wheat have long been recognized as adapted to dry, porous soils. Corn, although the cool nights check its growth, does fairly well, particularly in the southern portions of the West. Many of the grain sorghums are widely used, as Kafir corn, durra, and milo. Alfalfa is raised for its seed.

[2] At a Utah experiment station, experiments have shown that it takes 45 tons of water to produce 1 bushel of wheat. A rainfall of 10 inches a year is equivalent to 1130 tons of water an acre. If all this could be directed into the wheat plants without loss in run-off, evaporation, or seepage, it would supply the water required for 25 bushels of wheat. If half the rain water were lost, 10 inches of rain would grow 12½ bushels, and 20 inches would grow 25 bushels.

Many of the crops now grown in the arid lands are centuries old. Civilization developed in irrigated river valleys and the semiarid deserts of Asia and Africa, and many of the crops we raise today were cultivated by man even in the primitive stages of his development. From the Old World semiarid areas we have introduced, mostly since 1910, plants admirably suited to the arid land of the West. Many agricultural practices in these Old World lands, although primitive and traditional to a high degree, are nevertheless successful and must be considered as dry-land farming methods. The Indians of northern Mexico and southwestern United States, long before the coming of the Spaniards, raised corn and must perforce have used some of the methods now employed by the white man. Certain phases of dry-land farming have long been practiced on the chalk downs of England and France, in many parts of the Mediterranean area, and in southern Russia.

Important Dry-Land Farming Areas. Dry-land farming in English-America dates from about 1850, when some Mormons, through sheer desperation, because of failure to get water for irrigation, cleared a small area of sagebrush land and secured fair returns from the wheat sown. There are no definite records of these early experiments or of the methods used, but it is believed that many Mormons tilled the dry lands on the Wasatch Piedmont by methods they had worked out and found successful as early as 1854 or 1855. Moisture-conserving methods were used in the Sacramento Valley as early as 1861; in the Bear River Valley, Utah, by 1863; on Sand Ridge between Salt Lake City and Ogden, about 1865; and in eastern Washington in the Palouse region and in the Cache Valley, Utah, by 1870.

Considerable dry-land farming is still practiced in these areas today. Generally the nearness to irrigated lands with their crop varieties and cattle feed is an important factor in successful dry-land farming. Undoubtedly wheat is the leading crop, with the sorghums and other small grains also important.

The Palouse region and the southern part of the Great Bend of the Columbia Plateau has for more than three-quarters of a century been the most noted dry-land farming region of the country, and a major world wheat-producing land. It averages from 5 to 22 inches of precipitation annually, and the year-to-year variability is not quite as great as in most low-rainfall lands. The soils are basically lava and wind-blown loessal materials, and the original vegetation was sagebrush and bunchgrass. The land is sufficiently level for the use of large machinery to be applied to the culture of wheat. At first the machinery was drawn by horses and mules, but now the tractor-drawn gang plows, disks, and combines are used nearly everywhere. The major part of the wheat is the winter variety which is well suited to this land of maximum precipitation in the winter months, with a considerable portion of it in the form of snow. In 1951 the state of Washington ranked fourth as a wheat producer among the states. Its crop was over 75,000,000 bushels, a large part of which was grown by dry-land farming methods on the Columbia Plateau.

Because of the one-crop practice of growing wheat the soils of the Columbia Plateau have become worn, some erosion by wind and water has taken place, ground water has been partially depleted, and the wheat acreage has had a tendency to decline. Thus one of the aims of the Columbia River Basin Reclamation Project is to irrigate a large portion of the Great Bend area with water drawn from the Franklin D. Roosevelt Lake above Grand Coulee Dam. The dam and Grand Coulee Reservoir are complete, canals to lead the waters over the plateau, and some irrigation has begun.

In the early 1880's many farmers were attracted to the Great Plains of Kansas and Nebraska by cheap land and immense yields of wheat. They used humid-land seed and methods in a region that had long been considered as a part of the "Great American Desert." The idea was advanced that rain—in increasing amount—followed the plow. All that was needed, therefore, to make the Great American Desert a productive farming region was to turn over the sod. The great profits made for the first few years attracted farmers from all over the northern states and some from the South. These ventures happened to have been made during a period of rainfall heavier than the normal, and when the annual precipitation went back to the normal there were failures on every hand. Farms, villages, and towns were abandoned, although a few farmers remained. Some of the farmers went into stock raising; others modified their methods of tillage and were able to live on, yet with greatly reduced standards of living. They were the first of the dry-land farmers of the Great Plains.

Again following World War I there was a demand for wheat to feed Europe's millions where wheat lands had been devastated by armies and production was curtailed by the disturbed economic conditions. The United States Government supported high prices, and with the aid of tractors and improved machinery dry-land wheat farming encroached again upon the more arid grass and range lands. In the 1920's, years of above normal rainfall further encouraged wheat growing, but in 1930, 1934, and 1936 the rainfall was below normal. Many thousands of wheat farmers went bankrupt because of having no crops. Dust storms prevailed on the Great Plains from Texas to the Dakotas and were the most severe in the history of the Great Plains. The most vigorously blown area was the winter wheat and grazing land of southwestern Kansas and portion of the adjoining states, referred to as the "Dust Bowl," though this term is also generally applied to all of the Great Plains that was wind blown.

It has been estimated that about 16,000,000 acres were damaged by having the topsoil blown away, thus leaving the land unsuited for dry farming, or even for grazing thereafter. Since the 1930's the rainfall has been mostly normal or above, and natural grasses are slowly returning. Man has aided by regrassing large areas, and has used new farming techniques and soil-erosion preventive measures of the federal and state agencies (Fig. 171). The Dust Bowl is gradually being reclaimed, but the loss has been great.

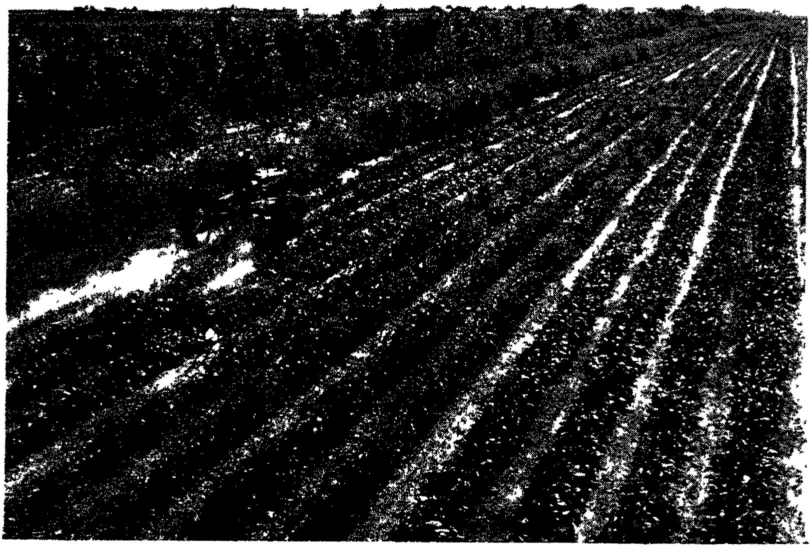


Fig. 171. A shelter belt in the dry-land farming section of northern Texas. The planting of trees was government supported, and much advocated following the dust storms of the 1930's, in all the eastern Great Plains region from Canada to Mexico. It is claimed trees serve as protection against hot winds in summer, and cold winds in winter; they preserve moisture; they aid in preventing soil being blown away; and they furnish wood.

The Great Plains is naturally a grazing and dry-land farming region, but throughout its history it has been a major land-use problem area.

Undoubtedly it is, in the main, capable of great production but somehow man must use such methods that when drought years come losses may be curtailed and the soil saved from being blown away.

HUMID-LAND FARMING

The area devoted to humid-land farming in the West, as earlier stated, is very limited, being confined almost entirely to the Puget Sound Trough in Washington and Oregon.

The Physical Environment in the Trough. The term "trough" no doubt implies in the minds of some readers an area of level lowland between parallel mountain areas. But the surface is anything but level. The central portion of the trough is chiefly rolling uplands interrupted by hills and broad valleys; and the borders of the trough are thoroughly dissected foothills or lower slopes of the mountain areas. The area is remarkably well drained, marshes or ponds being found only on the valley flats.

The trough is structural in origin. The northern portion is glaciated. There are deposits, therefore, from the glacier and from the fluvio-glacial waters. Stream action, both before and since the glacial period, has produced minor erosion features both in the trough and on the bordering slopes; and the water from the mountain areas has deposited some rock debris. Four types of soils, based on origin, are recognized: residual soil on the uplands, hills, and mountains; soils from deposits by glacial ice and by fluvio-glacial waters, occurring in morainic deposits, kames, outwash plains, and terraces or dissected valley trains; soils of (recent) flood plains; and a few small areas of lacustrine or marsh soils.

The moist climate over the whole area favors the growth of forests; and, since the portions first lumbered were along the larger streams, it is in the bottoms and on the terraces that the older settlements and the denser populaion are found. The great difficulty of clearing the land is no doubt one cause of the slow economic development. The dense stand of timber and the large size of the trees make burning about the only method that may be used to rid the land of stumps and unmerchantable logs after the lumberman has taken his toll, and this makes the cost of clearing much greater than in other forested sections of the country. Burning also destroys much of the humus of the soil.

The Youth of the Region. One of the earliest settlements in the Pacific Northwest, a trading post, was made on the Columbia by the Hudson Bay Fur Company in 1828. In many respects the area under consideration is young. Its agricultural youthfulness is shown in the small amount of land in farms, the small amount of farm land improved, the general lack of attention given crop rotation and its relation to soil fertility, the neglect of most of the orchards, and the general lack of specialization and adaptation of crops to climate and soil. It has been discovered, however, that a few products and types of agriculture give better returns than others.

Land Utilization. The cool, wet winters (about 50 per cent of the rain comes between November and February) and mild, moderately dry summers, with the ground most of the year well supplied with water, offer admirable conditions for the growing of cool-weather crops. Oats, flax, and hemp are grown on the alluvial bottom lands. The yield of oats is high. Hops growing was once important but has greatly declined, owing chiefly to the uncertainty of securing paying prices for the crop. Potatoes seldom fail to produce abundantly. Nearly all garden vegetables are grown in all sections. Cabbage, kale, and mustard do exceptionally well, but are grown largely for the home market. The leading cabbage-seed-producing area in the United States, however, is centered in King and Skagit counties, Washington. Canned peas from Puget Sound now also reach the markets east of the Mississippi River. The abundant fod-

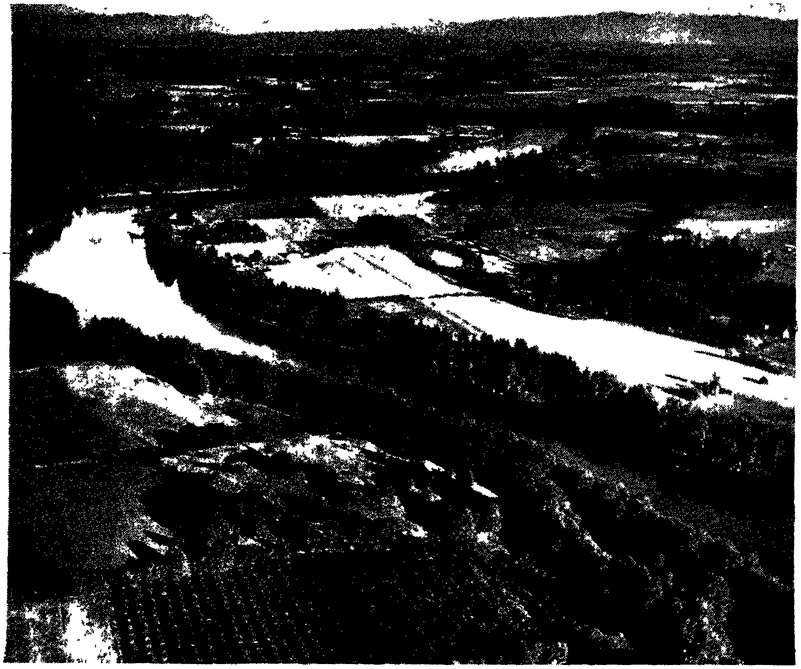


Fig. 172. Fertile farm land in the Willamette Valley of western Oregon.

der, the long grazing season, the mild winters, and the pure water of the streams favor livestock raising. Dairying is one of the leading types of agriculture in the region. A large plant for the manufacture of condensed milk is located in Washington, and numerous small creameries are scattered over all these counties, supplying cream and butter to the larger cities of the trough. The breeding of improved livestock is receiving considerable attention. Most of the dairying and raising of livestock is found on the upland areas.

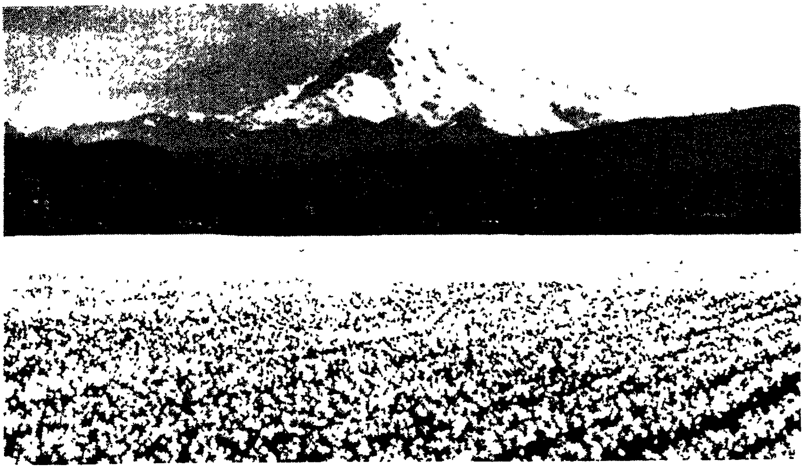


Fig. 173. The Puyallup Valley in western Washington. *Courtesy, Tacoma Chamber of Commerce.* Although lofty Mount Rainier in the background (14,408 feet) is snow covered the year round, the climate in the valley and Puget Sound region is mild both summer and winter. Daffodils shown in the foreground bloom in March and April. This valley is near Tacoma and is noted for bulbs and berries.

Because of the great expense of clearing more land throughout most of the Puget Sound—Williamette Valleys—there is a tendency towards a more intensive use of land (Fig. 172). Butter and cheese is of increasing importance. The poultry industry is particularly profitable in the Puget Sound area where cooperative egg marketing follows the model of Petaluma, California.

Among the deciduous fruits, prunes receive most attention. The center of production is in Oregon where orchards are numerous and much attention is given to their care. Apples, pears, cherries, and quinces are beginning to be grown on a commercial basis. Since 1940 the filbert has become an important nut-tree crop in the trough. Most of this comes from Oregon, but considered together with the Washington crop it constitutes about 99 per cent of the total for the United States, and frequently has an annual value of over $3,000,000.

Since World War I the growing of daffodil bulbs has become important in the Puyallup Valley, where the climate has a striking resemblance to that of Holland. Dutchmen migrating to Washington brought the business with them and the prominent growers today are Dutch. The bulbs reach the eastern market for winter use, and they represent about 50 per cent of the daffodil bulb crop of the United States (Fig. 173).

There is an apparent tendency to select rolling land and slopes for orchard crops. Every year shows an increasing attempt to adjust the products of the area to improved market conditions. The production of bush fruits is profitable, the climate being particularly adapted to the growing of raspberries, blackberries, loganberries, and strawberries. An evergreen blackberry grows wild and furnishes a valuable crop in the newer sections. The present production of any of these crops is no indication of the potentialities of the region. Although this humid area has been settled for about a century, the rate of agricultural development has been slow and is much slower than in the irrigated areas. Economic development here is the result of individual initiative with only a minimum of cooperation of state or national paternalism.

The Markets for the Region. The trough offers fairly easy grades for railroad building, although numerous cuts and fills are necessary, and since it contains all the large urban centers of the Pacific Northwest the farmers everywhere have good railroad transportation facilities to the trough cities, and from these cities to the other parts of the United States. The bulk of the surplus agricultural products finds a market in the cities of the trough. Condensed milk and dried prunes have long been the chief products that reached distant markets, but since about 1935, as has been stated, the filbert has been added to the list, and there are increases of distant marketing for berries, and a few other crops. A beginning has been made at cooperative production and marketing in the trough, and this promises to increase.

CHAPTER 17

The Livestock Industry in the West

SOME GENERAL CONSIDERATIONS

Because of the large area of mountains, and aridity and remoteness, the West has been and continues to be a grazing land in preference to one for field crops. In the area between the Rocky Mountains and the Sierra Nevada-Cascade Mountains only about 3.5 per cent of the land is in field crops, and this cannot be appreciably extended even by irrigation. Obviously for a long time before the coming of white man, the bison, deer, and antelope ranged the Great Plains as well as the other semiarid grasslands throughout the West, including southern California and the Great Valley. Animals were hunted by the Indians, but probably never to the extent that their numbers were cut down materially, nor is it likely that these animals overgrazed the lands, for they were free to shift about as grasses became short in given places. There was an adjustment of animal life to vegetation in such a way that no great "dust bowls" developed, and there was no forced overgrazing of the lands for profits, since Indians had not domesticated the grazing animals.

Horses, cattle, hogs, and sheep as we know these animals of common and widespread use in North America did not exist here before the discovery of America. It is true that fossil remains of the horse and camel are found in the rocks of North America, but these animals had been extinct for many centuries before Columbus.

Animals of the European varieties were brought by the Spaniards; at first the horse was used as a means of travel, and the others perhaps as an assurance of a supply of meat in a new and unfamiliar land. Many animals escaped or were turned loose as they became no longer useful on the exploring expeditions. Hogs became wild and thrived in their natural habitats of oak, hickory, and beech forests of the Appalachians, the Ozarks, and elsewhere. Horses and cattle found the grasslands a natural habitat, where they thrived and reproduced in numbers so greatly as to compete for the range with the bison and other native grazing animals. It must be noted that Spaniards first brought the European grazing animals shortly after 1500. It was not till after 1800 that Americans began to move into the great area west of the Mississippi River. Three centuries of time had been sufficient for great droves of cattle and horses to have been produced and spread, particularly in the grasslands of Mexico, southwestern United States, and on the Great Plains. Then too, in these areas, all of which were claimed and thinly occupied by the Spaniards, the grazing industry began. Though many Spaniards came because of the lure of precious metals, the Catholic missions were established and grazing industries grew around them because of their stationary nature. Spaniards who failed to find metals turned to ranching. This was true for many places in what is now known as Texas, New Mexico, Arizona, and California.

As early as 1769 the Spanish began their missions in southern California, and the cattle barons soon followed, selecting suitable coastal valleys and even some parts of the Great Valley. Even in the 1700's, long before the California Gold Rush the Spanish had extended ranching into southern Arizona and into the upper Rio Grande Valley, where large lands were held as grants from the Spanish crown. In fact, the Spanish had a marked influence on the entire Southwest. Their cattle, sheep, and horses formed the basis for the Southwest's grazing industry. Their horses gave mobility to the Indians, and in their missions and scattered settlements, such as those at Santa Fe, Los Angeles, and San Diego, they left the stamp of their architecture, which is still a model.

The chief products of the Spanish cattle industry were hides and tallow. San Diego became a port where Yankee ships traded and left their New England wares, and this trade reached as far inland as Santa Fe. The Spanish cattle and horses from Texas found an early market at New Orleans and Baton Rouge during the first two decades of the nineteenth century.

THE AMERICAN CATTLE INDUSTRY IN THE WEST

The American cattle industry was greatly stimulated after the Mexican War and the California Gold Rush. In California and the far Southwest the large Spanish ranchos were gradually taken over by Americans who found an increasing meat market in that state, for the population had passed 100,000 by 1851. Soon thereafter the cattle-ranching business was extended throughout the lower Great Valley and into parts of the northern Great Valley.

It was in the High Plains region, however, that the cattle industry took on large proportions in the decades following the Gold Rush. England was growing industrially; the population of the entire United States was also growing rapidly; and the demand for meat products rose. As roads and railways were extended westward from the Mississippi the bison was much hunted and was rapidly exterminated. It was estimated that in 1889 there were not more than 1000 head on the Great Plains, and the cattle era had been ushered in during the 1870's and 1880's. The decrease in numbers of bison made more range for cattle; and in addition to the great cattle drives from Texas to the railroad ends such as at Abilene and Dodge City, many drives were made for the purpose of stocking the ranges northward in the Great Plains.

The cattle business became one of the "open range" throughout the West, but mainly on the Great Plains. No one owned the land. Watering places were commanded, and cattle were grazed far and wide from these as centers. There began to be great competition among cattlemen for rights at watering places, also a competition with settlers who were homesteading and initiating wheat growing. Barbed wire was invented in 1873 and was soon to be had on the market. With it the cattlemen and wheat farmers alike could fence their holdings readily with the scant supply of posts provided by such growths of trees as could be found along streams and other places in this semiarid land. Gradually cattle ranching was crowded onto the more arid lands, which ceased to be "open range." Cattlemen have come to the practice of owning or leasing lands and to having them fenced.

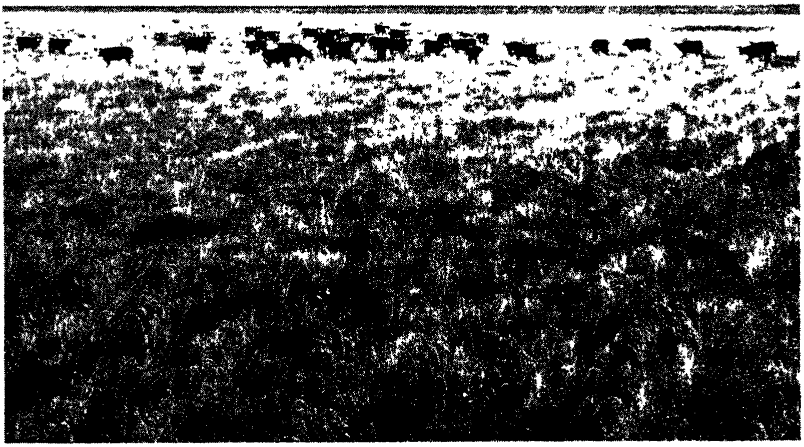


Fig. 174. Beef cattle—the white-faced Hereford on the High Plains in the Panhandle region of Texas. *Courtesy, U. S. Department of Agriculture.* This photograph shows a field that has been turned back to grama grass after cultivation. It covers the soil completely, thus preventing "blow-outs" common in the region.

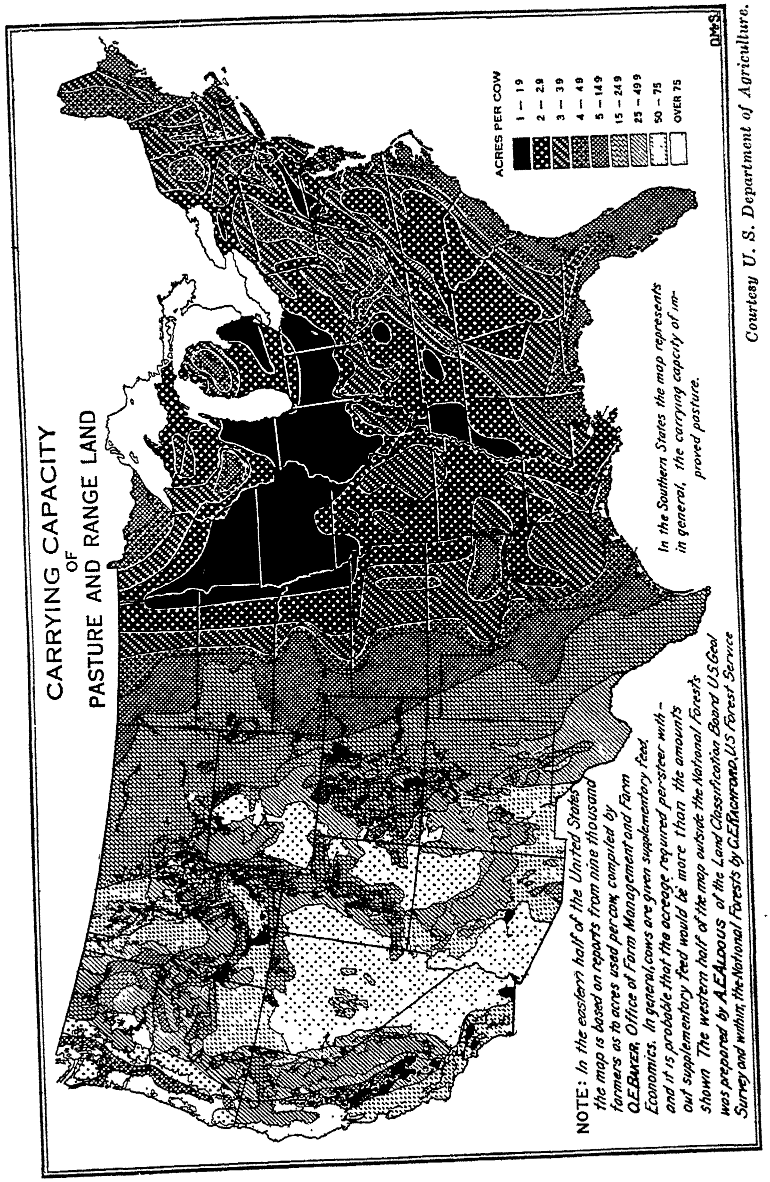
Since about 1910, although cattle have increased in numbers in the West as a whole, they have not increased in many parts of the Great Plains. World wars and the economic conditions resulting therefrom stimulated prices for wheat, and farmers with improved agricultural machinery encroached farther into the more arid High Plains for the profits to be made in extensive wheat culture. The low rainfall and a drop in wheat prices later brought disaster to wheat farmers and to the lands of the region in the 1930's. Wind erosion on millions of acres created the United States "Dust Bowl." Although ranching is gradually returning to much of the area, it will require a long time and good management to bring back the growth of grasses suitable for profitable grazing. For some areas it may never be accomplished.

Regardless of the encroachment of wheat culture, the dominant industry on the Great Plains is ranching. The size of a ranch may be large—2000 to 100,000 acres—for the carrying capacity of the range in some places is so low that from 15 to 40 acres or more are required for one cow. Throughout this entire region the variability of the precipitation from year to year remains an important factor. Even after the experiences of the past, the range is still overstocked in many places. However, the most hopeful aspect is that there is an increasing number of conservative cattlemen who will not stock their ranches with more cattle than can be carried in dry years (Fig. 174).

Originally the natural springs and streams of water were relied on for watering cattle. With improvements in well drilling to secure deep-rock water or larger wells of surface water, the windmill and gasoline pump have been put to use to supply tanks for watering. This makes it possible to graze much land where water was not available before.

In numerous areas throughout the Rocky Mountains and Intermontane basins and Plateaus of the West cattle ranching continues to be an important business. The large ranch dominates here also because it is best suited to the semiarid and mountainous lands which have a low carrying capacity (Fig. 175). It is estimated that fully 50 per cent of the grazing land of the West is still public land, not privately owned, and cattlemen have long practiced driving their stock to the public lands for short grazing periods (Fig. 176). This is particularly true in mountainous areas where it is too cold and the snows are too deep for cattle in winter, but there is good grazing in the summer. This transhumance—herding animals to mountain pastures in summer, and back to home ranches in winter—is a widespread practice throughout the West (Figs. 177 and 178).

The evils of the practice lie in the fact that it was made a "free-for-all" in a contest for the pastures, and resulted in overgrazing to such an extent that laws have been passed regarding it. The Taylor Grazing Act of 1933



In the Southern States the map represents in general, the carrying capacity of improved pasture.

NOTE: In the eastern half of the United States the map is based on reports from nine thousand farmers as to acres used per cow, compiled by O.E.BAKER, Office of Farm Management and Farm Economics. In general, cows are given supplementary feed, and it is probable that the acreage required per steer without supplementary feed would be more than the amounts shown. The western half of the map outside the National Forests was prepared by A.E.ALDOUS of the Land Classification Board U.S.Geol Survey and within the National Forests by C.E.RACHFORD, U.S Forest Service

Fig. 175. Carrying capacity of pasture and range land in the United States.

Courtesy U. S. Department of Agriculture.

closed much public land for further homesteading, providing for grazing fees, and limited and regulated the amount of grazing on the Public Domain. At first this law incensed many cattlemen because it interfered with what had for a long time been their privilege, and it probably resulted in financial hardships for some. However, since the law went into effect the carrying capacity of the public lands has increased to the benefit of cattlemen in general.

Perhaps the most important change in the cattle industry of the entire West since about 1935 is the decline in shipping "feeder" cattle eastward to the Corn Belt for fattening, though considerable of this is still done, and the increase in the fattening of cattle at home. Advances in irrigation for crops has brought about a combination of ranching and cropping where cattle are fattened on the ranch. In Texas, southern California, the Yuma district in Arizona, and other locations in the South, the feed is cottonseed cake and alfalfa. In the middle and northern parts of the West, the fattening of cattle is associated with the sugar beet crop, where pulp is used as a feed along with alfalfa and other hay crops. Also, since the great dust storms of the 1930's, there has been an improvement in dry-farming methods, and other soil conservation measures, so that agriculture is encroaching westward again on the Great Plains where the cattle business is associated with mixed farming on ranches that are not large, and the breeds of cattle are much improved over those used in former times.

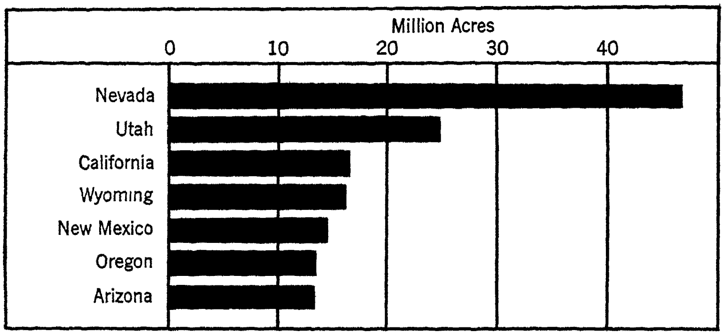


Fig. 176. Vacant public land in the United States, by leading states in 1950.

Although the cattle industry still is important in the West, it should be noted that, for the area included, it is not so impressive. The West contains more than one-third the surface of continental United States, but it had only about one-sixth of all cattle in 1950. However, in comparison with the total population of the West, the record is better. When these

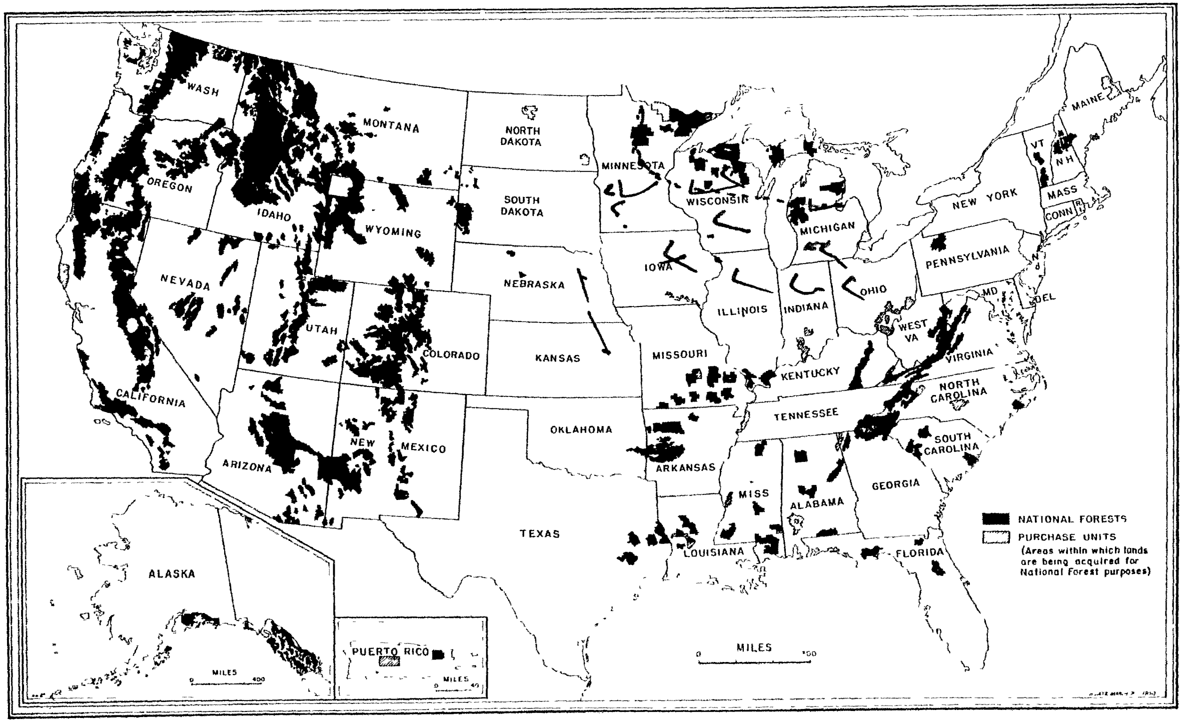
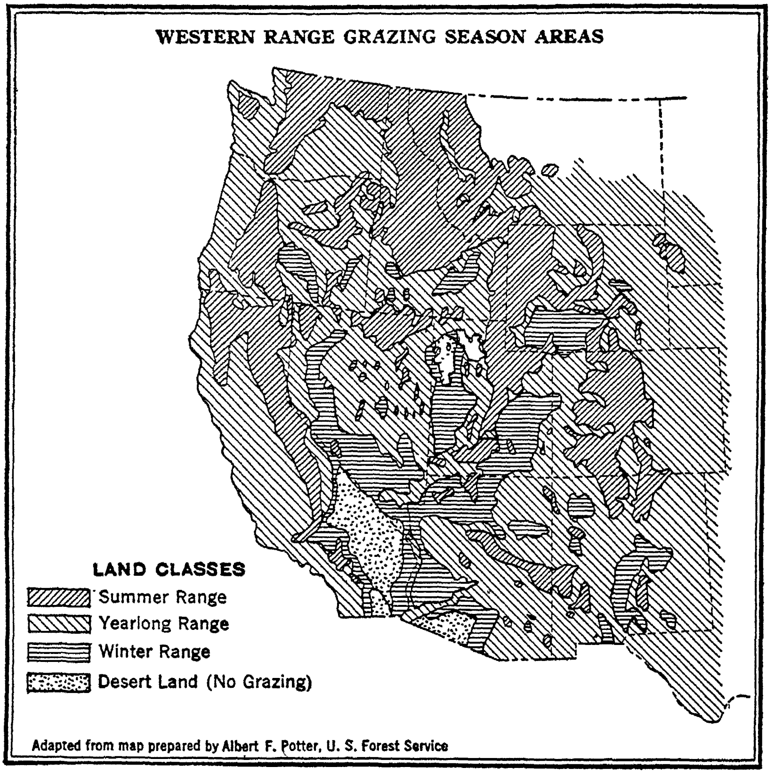


Fig. 177. National Forests of the United States. *Courtesy, U. S. Forest Service.* The dominance in the West is due to the large area of unappropriated public lands that was turned over to the Forest Service merely by an Act of Congress. Most of the forest reserves in the eastern half of the country have been secured only by purchase.

numbers are reduced to the basis of cattle per 100 people (1950) the West had 70 and the country as a whole 55.

Slaughtering. The slaughtering of cattle and calves has increased since 1940 in the Pacific states because the growth in population there provides a market for more meats. This is particularly noticeable in the Los Angeles area, the San Francisco Bay area, and in the Willamette and Puget Sound areas. The chief market for cattle of the West continues to be the supplying of "feeder" cattle to the agricultural interior where they are fattened on grain and good pastures before being sent to market for beef. However, increasing numbers are being fattened in the West on irrigated areas, and shipment to the West Coast slaughtering centers is increasing. Some cattle from the Great Plains now reach the West Coast market.



Adapted from map prepared by Albert F. Potter, U. S. Forest Service

Fig. 178. Western range grazing season areas. The summer grazing lands are largely in the mountains and higher plateaus: the winter ranges are in the lower lands.

Denver has long been the leading livestock and packing center in the West because of its central location in the Great Plains. However, the entire West, with the exception of California and Washington, is still the large surplus-cattle-producing section of the United States (Fig. 179).

Dairying. Dairying in the West, as in other sections, is associated with large population centers. In the Los Angeles area there is much dairying in irrigated lands where alfalfa and other hay crops along with some root crops are produced for feed. Alfalfa is a highly nutritious food for animals, and several crops may be produced each year if irrigated lands are managed well in this subtropical climate. In the San Francisco Bay area dairying is carried on extensively in the marsh lands, particularly to the south of the bay and in the lower San Joaquin Valley. Here also much alfalfa and other feed crops are grown, and considerable use is made of

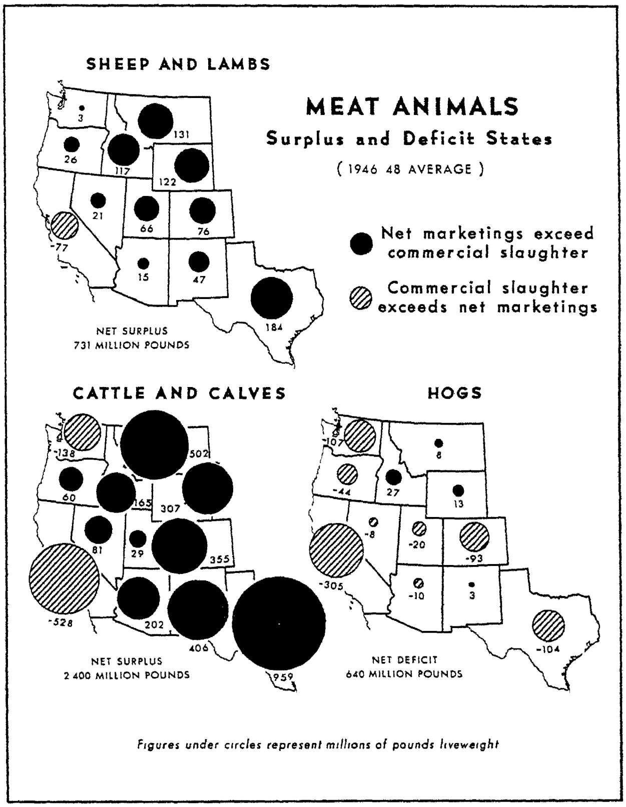

SHEEP AND LAMBS
MEAT ANIMALS
Surplus and Deficit States
(1946 48 AVERAGE)
● Net marketings exceed commercial slaughter
▨ Commercial slaughter exceeds net marketings
3
131
26
117
122
21
66
76
-77
15
47
184
NET SURPLUS 731 MILLION POUNDS
CATTLE AND CALVES
-138
502
60
165
307
81
29
355
-528
202
406
959
NET SURPLUS 2 400 MILLION POUNDS
HOGS
-107
8
-44
27
13
-8
-20
-93
-305
-10
3
-104
NET DEFICIT 640 MILLION POUNDS
Figures under circles represent millions of pounds liveweight

Fig. 179. Western states showing surplus and deficit in meat animals.

the native grasses where the soil is too compact and too high in alkaline materials to be used for truck crops. In the Puget Sound region and the Willamette Valley great dairying interests are found, which supply fluid milk for the urban centers. The moist, mild climate is particularly suited to dairying. The Denver area is supplied with dairy products largely from the irrigated lands to the northeast of the city, where alfalfa, sugar beets, and other root crops are important dairy-cattle feeds.

At many places throughout the West both dairying and beef-cattle raising are associated with irrigation. The cattle industry has brought success to many irrigated tracts. The feeds are easily grown. The labor of the farm or ranch is used to a better advantage than would otherwise be possible. The "off-season" is reduced to the minimum, for here is continuity of production. The returns are certain. Cattle also furnish the best of fertilizers for the land, which is called upon to produce its maximum. The number of dairy cattle in the beef-producing areas, away from population centers, however, is small. The families on many beef-cattle ranches purchase condensed milk for family use and buy out-of-state butter or butter substitutes.

It should be kept in mind, however, that slaughtering and dairying are small in the West, indeed, when compared with that in the North Central States, or even with some other sections of the country. With approximately one-third the area and one-seventh the population of the United States in 1950 the West produced for sale only one-twelfth of the milk of the country and one-fifteenth of the butter.

HORSES IN THE WEST

The horse played a great part in the development of the West, as it did in other sections of the country. Because of the long distances to be covered in the West, and the use of the horse for riding and cattle driving, and earlier, in drawing covered wagons and stage coaches, the use of this animal was spectacular. As has been noted, the horse was introduced by the Spanish in the early sixteenth century, and it multiplied and spread widely in the West, till, when the American westward movement reached the area in the 1800's, the numbers were great, particularly on the Great Plains, in California, and the Southwest. The adoption of the horse made many Indians more mobile than they would have been otherwise, and affected the course of history particularly throughout the entire West.

The horse became wild in the West. The early ranchers, to be sure, caught and tamed sufficient numbers for their use, but great droves of horses ranged the grasslands, taking the feed from the more profitable cattle, so that the cattlemen considered the horse a nuisance and in many instances destroyed large droves. In the wild state the horse in the West managed to maintain life even until the present time in the isolated, mountainous lands of Colorado and elsewhere. During the early decades of the twentieth century, the great interior grain belt was using many horses for draft purposes and prices were high. The tractor and automobile had not yet come. Some ranchers introduced draft breeds, thus building up on the ranges a type of western horse that could be shipped to the interior agricultural areas for sale to farmers. The farmers bought western horses (broncos) at low cost and tamed them to work, sometimes with much difficulty, for these animals were still semi-wild, to say the least. Frequently they made good, inexpensive work animals.

By the 1920's the tractor, the automobile, and hard-surface roads had come. The result was that fewer draft animals were needed, and the number of horses in the United States as a whole decreased from a peak of about 29,000,000 at the close of World War I to 5,500,000 in 1950. The decline was greatest in the agricultural interior, but it also affected all of the states of the West. Not one of the Western States has as many horses today as it had at some peak period earlier. On the basis of population the United States had 5.25 horses and mules per 100 of population, whereas the West had less than 5 per 100 in 1950.

In the cattle business, the horse is still a necessity in herding, roundups, and driving of cattle, but the total number of horses required is small. Horses are important still, in sections where roads are poor or non-existent. The Navajo Indians have become great users of the horse, because their roads are poor, distances are great; they use them in herding their flocks of cattle, sheep, and goats, and also perhaps because they are too poor and too unschooled in the necessary mechanics to own and operate automobiles. A Navajo's importance is still determined by the number of horses he possesses. However, the horse requires grasses of the range that might be a support for other animals, and the Navajo Reservation has for a long time been an overgrazed land and is becoming less and less capable of supporting the people. The United States Government has made some attempts to encourage a decrease in the number of horses on the reservation.

"Dude ranches" are now numerous in the West, and they make use of a considerable number of horses. Some people in some areas will continue to use the horse, but the day for large numbers of them has passed.

OTHER ANIMALS

Sheep. The Spanish sheep introduced into California and the upper Rio Grande were a hardy variety. Since their introduction they have not been as important on the whole as cattle, but in some sections they have been herded throughout the history of the region. The Navajo Indians took to sheep herding in the Spanish colonial period, and there was a period of sheep herding in the San Joaquin Valley before fruit growing began.

Due to the fact that sheep can browse on leaves, weeds, and woody plants and can nibble the grasses closer to the ground than cattle, sheep can make a living on much of the land of the West where cattle cannot get along. Regardless of this fact cattle became the dominant range animal in the West. They are larger than sheep and capable of traveling greater distances for grasses. They can run to escape forest and grassland fires; they can defend themselves against predatory animals where sheep become an easy prey. Nevertheless, the large area of arid and mountainous lands in the West makes it a natural region for sheep, and there has been much improvement in breeds since World War I. If western Texas is included with the 11 Western States, these states contained about two-thirds of the sheep and lambs in the country in 1950. The leading states were Texas with 6,628,000; Wyoming with 2,170,000; and Montana with 2,139,000. Sheep in the past were raised in the Western States mainly for

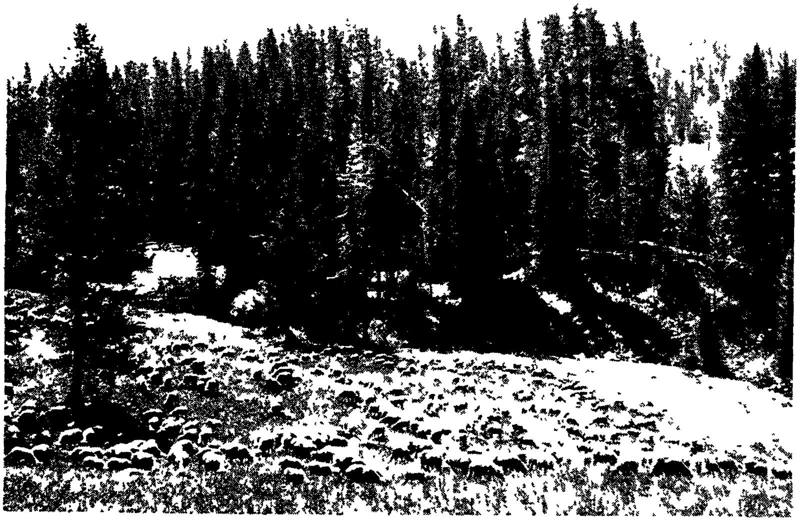


Fig. 180. Sheep on summer pasture in the Gallatin National Forest in Montana. *Courtesy, U. S. Forest Service.*

their wool, but now the sale of lambs brings in more than 50 per cent of the revenue.

Some Adjustments. Sheep raising in the West, as in all regions of scanty rainfall, is a pasture-chasing occupation. In the densely populated, humid portion of the United States the animals are kept in enclosed pasture lands in summer, and in barns or sheds, where they are fed, during the winter. These sheep produce the highest quality of mutton and wool. In the West, sheep raising is on the extensive plan; the flocks are large; the losses great; and the risks so many that the industry is often spoken of as a "game." The large size of the herds and the scanty pasturage force the industry to be, for the most part, migratory. In Texas and New Mexico enclosed pastures are common, but in many parts of the West it is only in the winter that the sheep are "at home" on their own lowland pasture lands. Here they graze on nature-cured hay or on green bunchgrass that comes up after the fall rains. In inclement weather and when food on the pasture lands is scarce or the surface is covered with snow, they are fed in corrals or housed in sheds. In the spring after shearing, the sheep are driven, or transported, to leased pasture lands or open ranges on higher, cooler, and moister plateaus and mountains (Fig. 180). In the Rockies, the Cascades, and Sierra Nevada, their summer grazing lands may be above the tree line and even bordering the summer snow line. A large part of the revenue derived from the National Forests is from cattle (previously discussed) and sheep leases. Since about 1940, grazing permits for 3,200,000 sheep and goats, and 1,200,000 cattle, have returned to the National Government about $2,800,000 annually.

Fig. 181. A flock of sheep on mountain pasture in Wyoming. *Photo by Miller.*

Summer grazing requires the services of herders, who keep the flocks in fresh pastures, care for the sick, and protect their charges from predatory animals. One man, with a saddle horse and a dog, can care for 2000 to 5000 sheep. With an "outfit" consisting of a covered wagon, bedding, cooking utensils, and other accoutrements, the herder follows the flock for months at a time. The herder is visited frequently by a tender from the home ranch who brings supplies (Fig. 181).

It is expected, if the year is good, that the wool clip will meet all expenses and perhaps return some profits. During such years the money derived from the sale of lambs is pure profit, but often, even with this, there is a deficit. The dry-land farmer has now so encroached upon the open ranges in the northern and cooler parts of the semiarid West that summer pasture lands are about limited to the National Forest reservations and the mountains. The free-range lands, as earlier stated, are so much in demand and so much depleted that most of the operators are forced to purchase tracts or lease from others. With leasing fees to pay or land to purchase, and increased wages since World War II, sheep raising is not so profitable as formerly. Careful management is a prime requisite for success, and more and more expensive equipment is being found necessary. In 1950 there were only 12,700,000 sheep and lambs in the 11 western states, in comparison to 33,000,000 in 1900. Many large operators have gone out of business, but since 1940 the number of small flocks in irrigated areas has increased.

Goats. Since goats are not used much as meat animals their numbers in the West have never been large. In 1849 the Angora goat was introduced into the United States. It was discovered that they did well in semiarid areas and that their long fleeces of fine mohair made a valuable product that could be used in upholstering furniture and automobiles. However, not till 1920 did the Southwest turn to goat raising on a commercial basis. By far the largest number of goats in the country are to be found on the Edwards Plateau in southwest Texas, where 90 per cent of the mohair of the United States is produced. New Mexico, Arizona, and Oregon produce a small amount each. This animal is exceedingly well adapted to the Edwards Plateau because, like the sheep, it browses on leaves of plants and coarse vegetation, as well as on grass. This part of Texas is chaparral country of cedar bushes, scrub oak, yucca, cactus, and prickly pear. The goat can manage to browse here even better than the sheep, and, too, the goat will put up a defense against dogs and predatory animals where sheep are helpless. Frequently goat ranching is combined with cattle and sheep ranching.

In 1950 Texas produced 12,643,000 pounds of mohair; New Mexico, the second leading state, produced only 155,000 pounds.

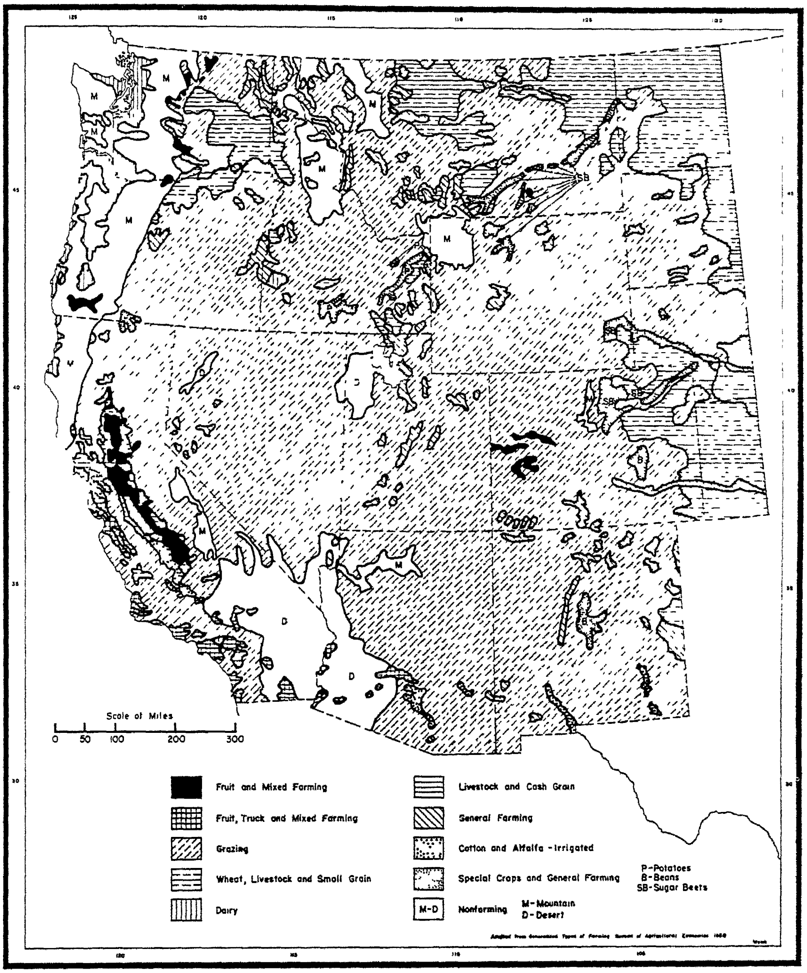

M
D
SB
Scale of Miles
0 50 100 200 300
Fruit and Mixed Farming
Fruit, Truck and Mixed Farming
Grazing
Wheat, Livestock and Small Grain
Dairy
Livestock and Cash Grain
General Farming
Cotton and Alfalfa - Irrigated
Special Crops and General Farming
P-Potatoes
B-Beans
SB-Sugar Beets
M-D Nonfarming M-Mountain D-Desert

Fig. 182. Types of farming in the West. *Adapted from Types of Farming, Bureau of Agricultural Economics, 1950.*

Swine. Although the raising of hogs fits well into the economy of an agricultural region that produces cattle, alfalfa, and sugar beets, the western states have few hogs in comparison with other sections of the country. There were in 1952 only 1,978,000 in the 11 Western States, to 46,000,000 for the North, and 14,200,000 for the South. California had nearly one third of the total for the western states.

The Poultry Industry. In all of the West there is no important poultry industry except in the coastal valleys of California, the Willamette Valley, and Puget Sound area, and some associated with the urban centers. North of San Francisco Bay in the Petaluma district of the Sonoma Valley is found the most important egg-producing center in the United States, if not in the world. A specialty is made of the white Leghorn chickens, and eggs are produced in quantity to supply more than the San Francisco area market. Great attention is given to marketing methods, and considerable quantities are exported. Some reach the Atlantic Coast cities in fresh condition and bring high prices.

A REVIEW OF AGRICULTURE IN THE WEST

Types of Farming in the West. The following map exercises on Fig. 182, an adaptation of a part of the Bureau of Agricultural Economics map entitled "Generalized Types of Farming in the United States in 1949," will serve as a review of the chapters on agriculture and livestock in the West. Study Fig. 182. In what portions of the West are grain crops important? What is the amount of rainfall in these areas? In what sections are the fruit crops? In what temperature regions are they? See if you can establish any direct relation of grazing areas to rainfall and relief.

What explanations can you give for the West having so large an acreage of non-agricultural land? Be specific. Discuss each area shown on the map.

Locate topographically and climatically (temperature and rainfall regions) the fruit areas; the dairy areas; cotton farming; poultry specialty areas; potato specialty areas.

QUESTIONS, EXERCISES, AND PROBLEMS

1. What contributions have plant explorers and plant breeders made to agriculture in the West? This task will require much research into literature dealing with crops.

2. What is the Campbell Method of dry-land farming? What adjustments did Campbell make to the semiarid conditions of the Great Plains?

3. What effect has increasing density of population in the Great Plains had on land utilization there?

4. What has been the relationship of the West and Middle West in the beef- and mutton-producing industries?

5. Make a study of Hoover (Boulder) Dam on the Colorado River. Note carefully the location of the area affected To what extent is this project devoted to water-power development? To what extent to irrigation for cropping and livestock industries? Give arguments for and against the expending of public money for such a development.

6. Make a study of the cattle industry of the West. The bibliography in this book supplies some references. Seek others. Write a paper on this industry as carried on in the West, emphasizing the adjustments man has had to make to climate, vegetation, density of population, diseases and pests, markets, and competition with other sections

7. Make a statistical comparison of agriculture in Nevada and Ohio. What explanation can be made for the vast differences?

8. Seek library references of Reclamation Service, Census Reports, or other sources to make a study of one or more of the following. The Imperial Valley Irrigation project, the Central Valley project of California, the Grand Coulee Dam and Columbia Basin Reclamation project. Emphasize source and amount of water, power development, crops, seasons, markets, etc.

CHAPTER 18

Manufacturing, Mining, and Other Industries in the West

MANUFACTURING

Comparison with Other Sections of the United States. The West is new. Its greatest growth in population has been made since 1870, in which year the territories of these 11 states had only about 1,000,000 people. In 1950 the population was 19,435,000, and, although it increased over nineteen times in 80 years, there is still much room for expansion. As was stated previously, not half the potential irrigable land has been settled on, and certainly large areas of dry land are yet to be developed, and many hundreds of square miles of virgin forest that will some day be removed to give place to agriculture remain on the lowlands and slopes of the humid Pacific Northwest. History demonstrates that, as long as a people have large open spaces and new lands that may be developed, they will not be inclined to turn to the confinement of factory work with its exacting hours. To this extent the West has been handicapped in the development of manufacturing.

In manufacturing, the West is behind the country as a whole, yet there has been surprising development in spite of the youth of the region, and the extent of its undeveloped lands. The per capita net value of manufactures in the West in 1950 was 71 per cent of the average of the country at large—$565 per capita for the United States, and $405 for the West. These states produced 9 per cent of the net value of manufactures for the country in 1950, while the population was almost 13 per cent of that for the country.

Some Reasons for Growth of Manufacturing. One should think of the West as a section in which manufacturing is getting a good start and assuming greater importance every year, particularly in a limited number of types of industries: those producing articles largely for local consumption, and those involved in the preparation of raw materials for the distant markets where secondary manufacturing takes place. There are several reasons for the relative importance that manufacturing assumes in the economic life of the western states.

The Advantage of Distance from the East. First of all, it is less expensive for the West to produce many of the manufactured goods that it consumes than to import them, because of the long distance from the industrial centers of eastern United States and the consequently high freight rates. The long distance from eastern factories is an advantage to the western manufacturer, enabling him to pay higher wages than the eastern manufacturer and yet sell cheaper in western markets. The bulkier the article, the greater the advantage the western manufacturer has.

However, it must be noted that the West is demonstrating that in a few lines of manufacturing, the long distances from eastern markets and the great open spaces are not sufficient handicaps to prevent the development of manufacturing beyond the needs of the market of the western states alone. This is true of the airplane industry of Los Angeles and Seattle. It is also true of the production of aluminum and magnesium at or near the great hydroelectric power sites, and of the research, experimentation, and production of nuclear materials in the great arid and sparsely populated sections.

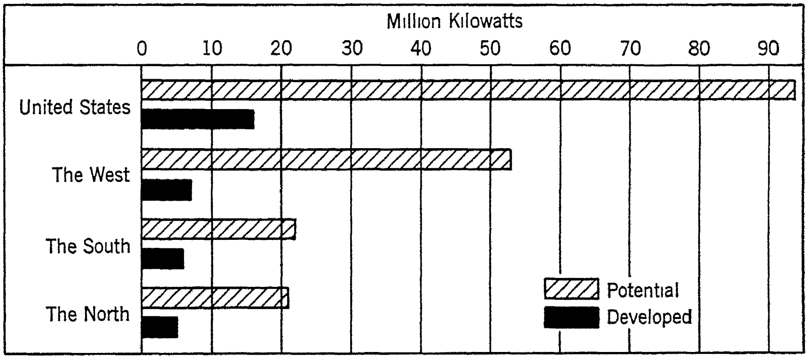


Fig. 183. Potential and developed water power of the United States and major sections. Federal Power Commission estimates, *Statistical Abstract*, 1949, p. 520.

Water-Power Resources of the West. A second reason for the growth of manufactures is the great supply of water power in the two sections where manufacturing is most important—the Pacific Slope and the Rocky Mountains. There is more power in the streams of the Pacific Coast states than in any other section of equal area in the United States (Figs. 24 and 183).

The potential water power of the West is estimated to be 52,803,000 kilowatts, or 52 per cent of the total for the United States. In 1947 the installed capacity of waterwheels in the West was 6,413,000 kilowatts, or 40 per cent of that of the country. The installed capacity represents only 12 per cent of the potential of the West (Table XIII).

TABLE XIII

DEVELOPED AND UNDEVELOPED WATER POWER OF THE WEST IN 1947
(thousands of kilowatts)

	Developed				Total
	Utilities	Industrial	Total	Undeveloped	Potential
Washington	1,642	27	1,670	14,182	15,852
California	1,986	2	1,988	7,925	9,913
Oregon	713	17	730	6,528	7,258
Montana	358	1	359	3,711	4,070
Idaho	282	2	284	7,746	8,030
Arizona	541	—	541	2,731	3,272
Utah	92	—	92	1,081	1,173
Colorado	87	1	88	1,115	1,203
Wyoming	50	—	50	928	978
New Mexico	25	—	25	183	208
Nevada	586	1	587	259	846
Total	6,362	51	6,413	46,390	52,803
Total for United States	14,971	985	15,956	77,130	93,086

The water-power plant, like the irrigation enterprise, must look to the mountains for its water, and the water of many streams is made to do the double duty of furnishing power and irrigating land; and in addition may be used, on its downward journey to the sea, if it ever reaches the sea, for domestic purposes.

The great fall of the mountain streams is the chief reason for the large amount of potential water power. In Washington, the richest state in the Union in water power, with more than a 15,000,000-kilowatt power potential, an additional factor is the heavy rainfall. Some of the mountain areas have the heaviest rainfall of the country. The same conditions prevail in most of western Oregon, northern California, and the northern part of the Sierra Nevada slope. In many parts of the Cascades and the Sierra Nevada, copious supplies of water are furnished by the melting glaciers on the high mountains.

All the states of the West richly endowed in water power, are, except California, in northern latitudes. Steep slopes, vast forests, numerous lakes, and a fairly low evaporation rate are all favorable conditions. Flathead Lake, Lake Pend Oreille, Lake Coeur d'Alene, and Lake Chelan are the larger lakes of value in equalizing stream flow. The Flathead River, the Snake, the Columbia, and many other streams have large water-power potentials.

The Great Basin, except about its borders where streams come down from the mountains, has little available water power. The rivers that rise in the Southern Rocky Mountain area, though not possessing so much power as those of the Northern Rockies, have enough to supply the increasing needs of the people in this part of the West for many decades.

Since about 1935 there has been a great increase in the development of water power in the West, particularly in the form of the large multiple-purpose project, largely by the United States Bureau of Reclamation. To a considerable extent these projects have been stimulated by the effort of the country in military production, but at the same time they have filled an urgent need for waters for irrigation, flood control, metropolitan uses, etc. Projects that are completed, nearing completion, and those in the initial stages will provide abundant power for the West, beyond the present needs of industry. In 1948 the West ranked high among the states in the percentage of farms receiving electric service, most of which was hydroelectric. Idaho and the coastal states now advertise abundance of electric power at reasonable rates to attract industry. Space does not permit of treatment of the numerous power projects of the West, but a brief descripion will be given of the three most important multiple-purpose projects, which have been brought to the attention of people everywhere. They are (1) The Columbia River Basin projects, (2) The Colorado River projects, and (3) the Central Valley project of California.

The Columbia River Basin Projects. The ultimate aim of the planners is to develop all the resources of the Columbia River that lie within United States territory (Fig. 184). The river rises in the snow-capped Rockies of British Columbia, and enters the United States in northeastern Washington. Together with its tributaries, the Snake, Spokane, and numerous others, the Columbia River basin within the United States includes much of the states of Washington, Oregon, and Idaho, as well as portions of Montana, Wyoming, Utah, and Nevada. The area is about 220,000 square miles, or one-seventh of the total area of the United States. The discharge of the Columbia River into the Pacific Ocean is estimated to be 160,000,000 acre-feet annually, thus being, next to the Mississippi, the largest in the country. On the way from the Canadian border to where it empties into the Pacific Ocean, a distance of 750 miles, the Columbia falls 1300 feet in elevation, a fact which, combined with the heavy precipitation in the mountain sources, gives the Columbia River, by far, a greater water-power potential than any river in the United States.

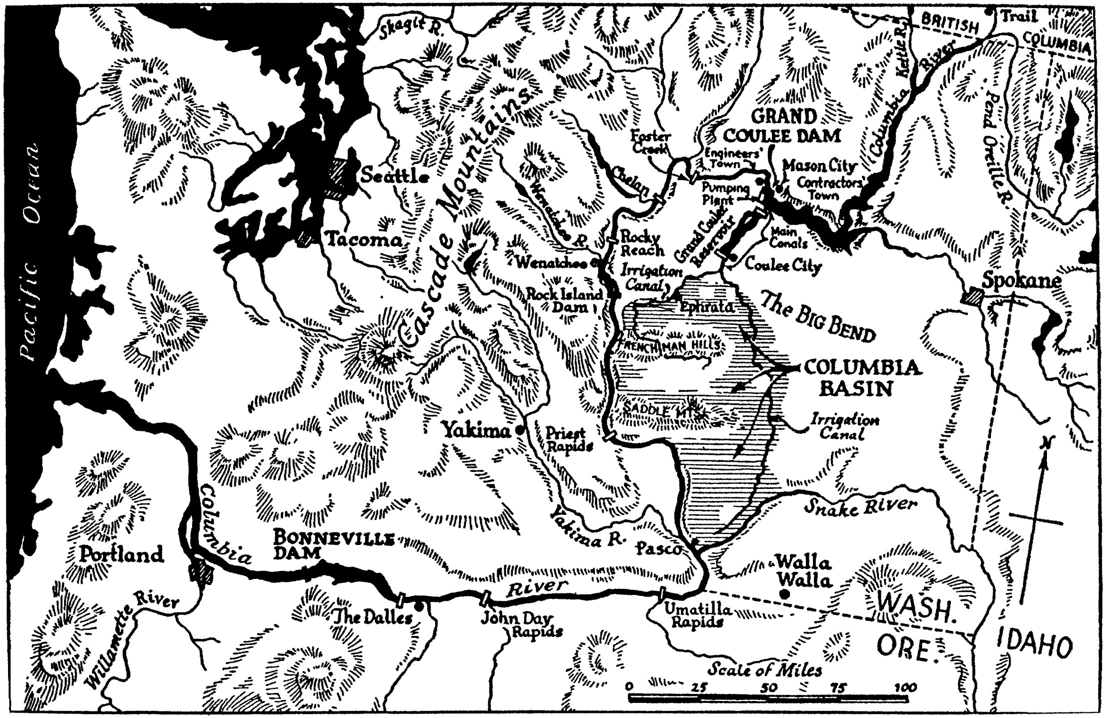


Fig. 184. The Columbia River basin showing main features of this multiple-purpose project—Grand Coulee Dam and Reservoir, Bonneville Dam, irrigation canals in the Great Bend, and the apple valleys, *Courtesy, Fortune*, July 1937, p. 84.

Numerous power sites are associated with the irrigation works on the Snake, the Spokane, and the many smaller tributaries, but the largest are at Grand Coulee and Bonneville. In 1950 there were over 200 hydroelectric power plants in the basin, with a generating capacity of 2,100,000 kilowatts. This was only about one-fifth of the potential water power of the basin, yet it represented 14.5 per cent of the water power of the nation. At present more than one-half of all hydroelectric power in the basin is developed at Grand Coulee and Bonneville, the most recent large developments in the region.

Grand Coulee Dam is located on the Columbia River in the state of Washington, about 100 miles south of the British Columbia boundary. It is the largest concrete dam in the world, and creates, in Franklin D. Roosevelt Lake, a reservoir of 5,000,000 acre-feet storage capacity. It is the master unit in the development of the entire basin, being strategically located at the beginning of the Great Bend where water is lifted into the Grand Coulee reservoir for irrigation on the Columbia Plateau, mentioned in Chapter 16.

Bonneville Dam is located on the Columbia about 50 miles above Portland, Oregon, where the river breaks through the Cascades. Its ultimate power capacity is 430,000 kilowatts. Although the Grand Coulee and Bonneville projects are the largest units in the basin and most important for power, they are only a part of the eventual total development where the purpose is supplying water for irrigation, flood control, and regulation of the waters, as well as power. During World War II the Northwest became the great center for electrometallurgical plants, especially aluminum, as well as the atom-smashing plants of the Hanford Engineering Works. All power systems, public and private, were interconnected to form the Northwestern Power Pool; the load factor was thus raised, and this in turn raised the total power available—an excellent illustration of regional planning and cooperation.

Power lines now deliver hydroelectric power throughout the Northwest, including all the cities of Puget Sound, and Portland, Spokane, and numerous others.

Colorado River Projects. The development of projects on the Colorado River represents one of the most ambitious attempts of man to put the waters of a nation to use (Fig. 185). This river has its sources in the Rocky Mountains of Wyoming, Colorado, Utah, Arizona, and a part of New Mexico. Here rainfall is plentiful, but the river flows southwestward and south through parts of Utah, Arizona, and southern California, as well as a part of Mexico, which is the driest region on the North American continent. The stream has been called America's most dangerous, because of its flash floods, its low water periods, its canyons, its heavy load

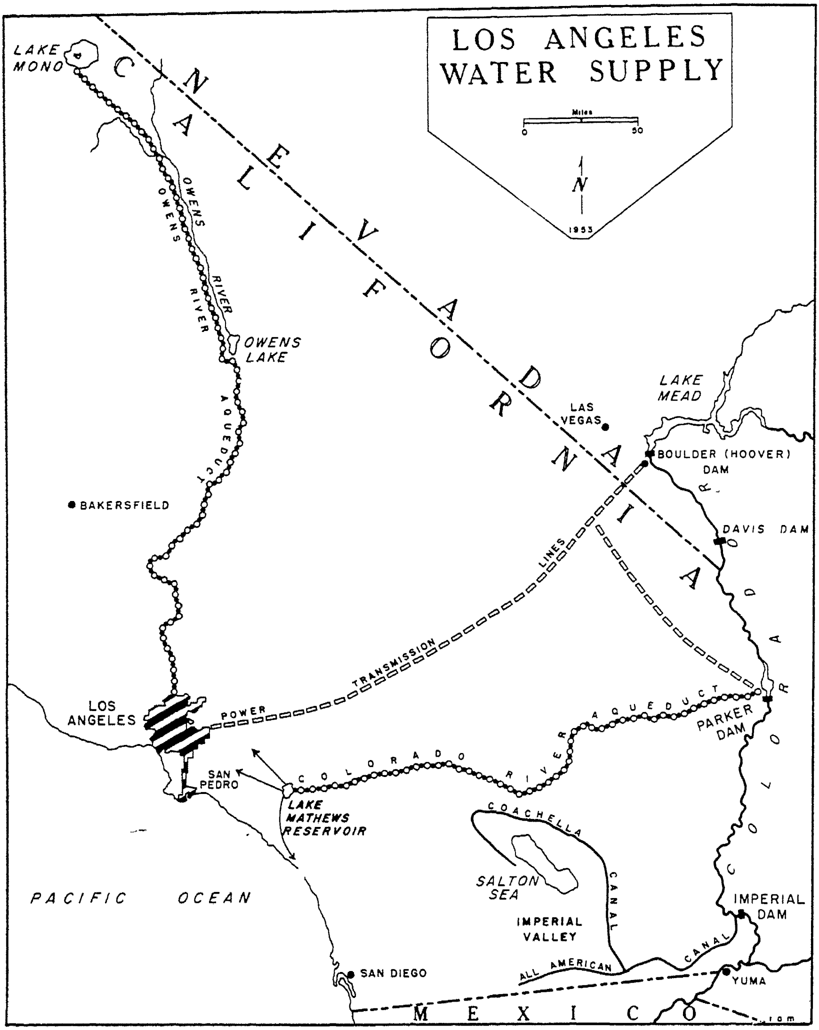


Fig. 185. Map of Colorado River multiple-purpose project. Note the location of Lake Mead, the dams, power lines, canals, and aqueducts, which carry water to Los Angeles, the Imperial Valley and southern California.

of silt, and its tendency to shift its channels in the Delta area at the entrance into the Gulf of California.

Today the Colorado River is fairly well under control. The key project is the Hoover Dam on the Arizona-Nevada border, which impounds Lake Mead. This dam is 726.4 feet high, and is said to be the highest in the world. The lake has a capacity of 30,500,000 acre-feet, and is the world's largest reservoir. The power plant has a capacity of 1,317,500 kilowatts. About 75 miles downstream is the Davis Dam, built largely as a reservoir to control the flow of the river and also for power generation. Still farther downstream, about 50 miles, is the Parker Dam, which develops power, regulates stream flow, and furnishes water for irrigation; but, perhaps most important of all, Havasu Lake above the dam furnishes water for the Colorado River aqueduct which in turn supplies the Metropolitan Water District of Southern California, mentioned in Chapter 16. Farther below in the Delta area above Yuma, Arizona, are the Imperial and Laguna Dams, which have multiple purposes, but which mainly impound water for irrigation projects—the Imperial Valley, Coachella Valley, Yuma, and Gila—and control the silt load of the river.

The main power development on the Colorado River is at Hoover Dam. From here a transmission line of high voltage carries power to Los Angeles, a distance of 300 miles. It is said to be the longest transmission line and the highest voltage (285,000 volts) used in the United States. Power from the Colorado River now reaches all of southern California and parts of Arziona and Nevada. The Colorado River development is truly a multiple-purpose project.

The Central Valley Project. The Central Valley of California is an area of about 25,000 square miles drained from the north by the Sacramento River and from the south by the San Joaquin, which join in a marshy delta near Stockton and then outlet into San Francisco Bay and the Pacific Ocean (Fig. 186). The valley is flanked on the east by the Sierras and on the west by the coast ranges. As has been stated previously, irrigation is practiced widely in the valley, with the major portion in the San Joaquin basin.

There are numerous water-power developments within the valley, but in the past there was no regional plan for coordinating the development of the water resources throughout. In 1930 a "State Water Plan" was suggested, which eventually became the "Central Valley Project" under the United States Bureau of Reclamation.

The stated purpose of the project is to provide storage and distribution of water for irrigation in the Sacramento and San Joaquin Valleys, to repel salt water from the Delta lands around San Francisco Bay, to produce power, to supply fresh water for municipal and industrial purposes, and to provide improvements for navigation and flood control. Construction began in 1937.

The entire project is unique in that the area is 400 miles long, and the Sacramento Valley has about two-thirds of the water supply whereas the San Joaquin Valley has about two-thirds of the land suitable for use. The

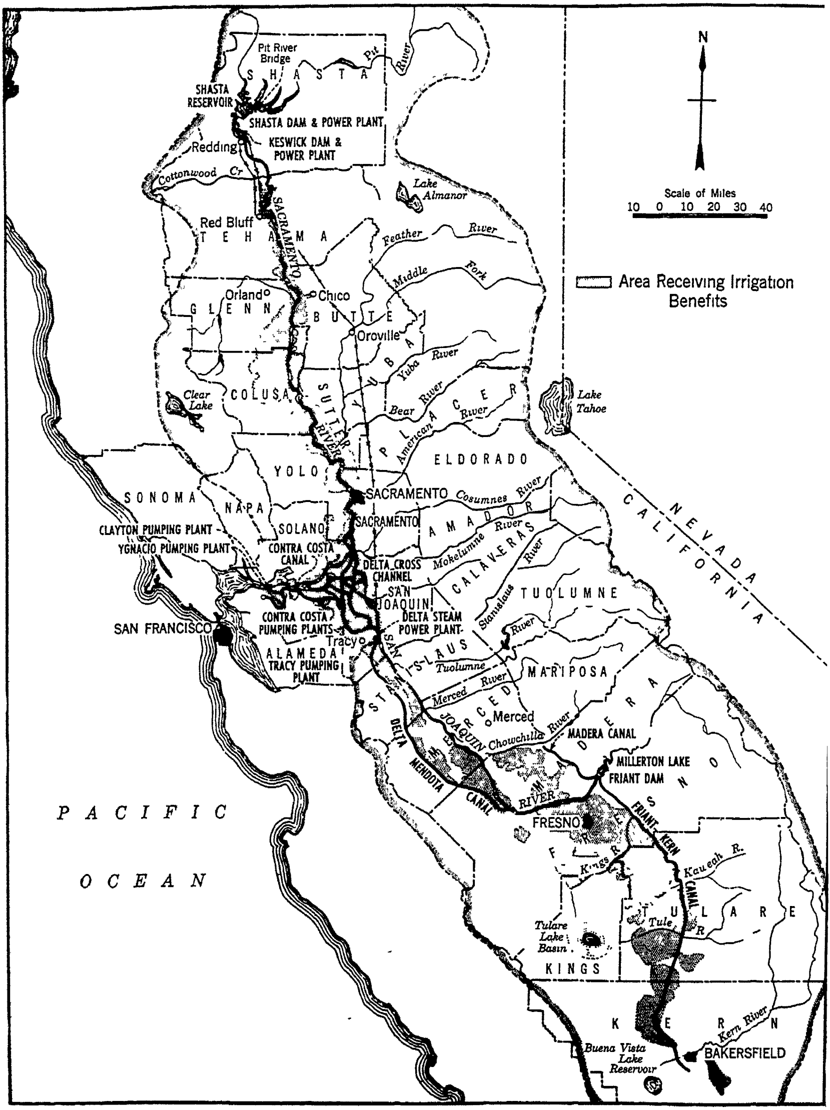


Fig. 186. Central Valley, California. One of the large multiple projects in the West, showing dams, canals, and irrigation areas in relation to Sacramento and San Joaquin Rivers. *From Reclamation Project data, 1948.*

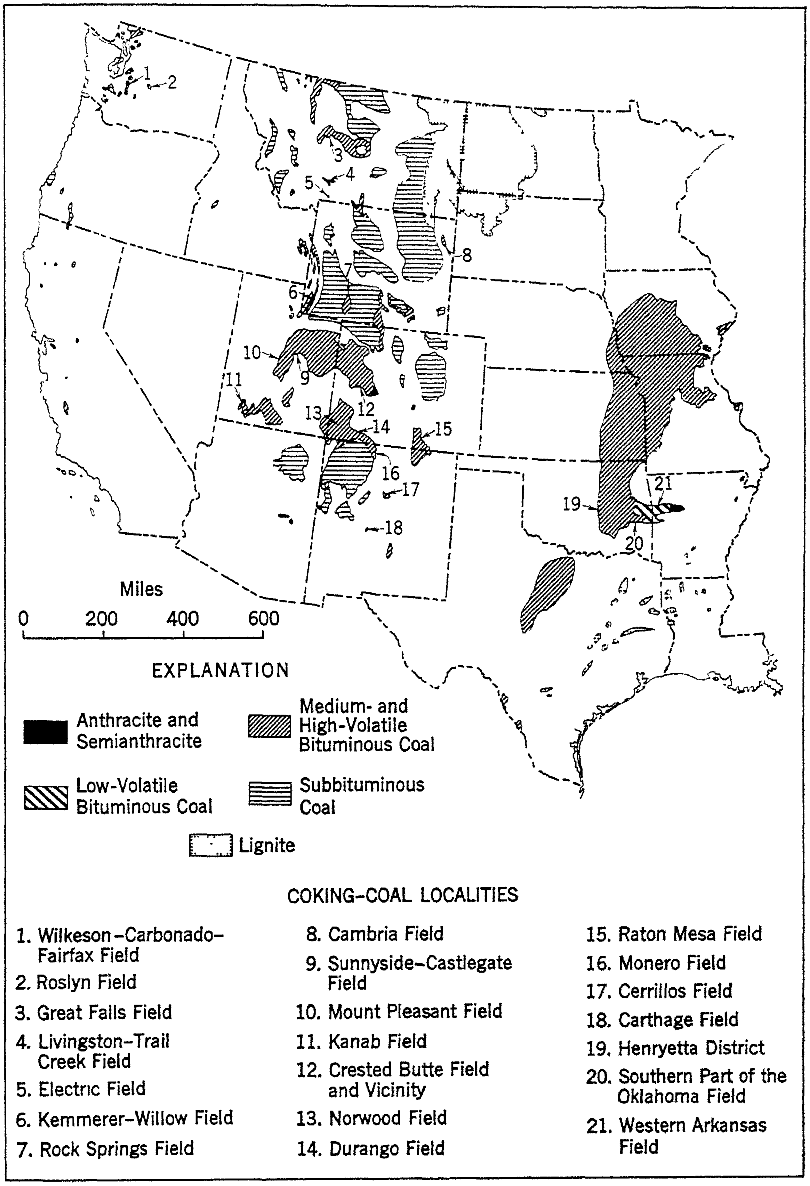


Fig. 187: Coking coal localities in the West. Note the concentration in the Northern Great Plains and in the Rocky Mountains; there is little in the Pacific States.

project thus involves a plan for taking water from the Sacramento to supplement the small supply of the San Joaquin.

The key unit in the Central Valley project is the Shasta Dam and Reservoir in the northern part of the valley. Here the winter flood waters are stored, and delivered through a system of canals to the San Joaquin Valley. Keswick Dam is located 9 miles down stream from Shasta Dam to provide regulation and storage of waters released from the Shasta power plant and spillways. At the south the Friant Dam forms a reservoir for the waters of the upper San Joaquin and supplies the Madera and Friant-Kern canals for irrigating the upper San Joaquin Valley. In the bay area the waters of the Sacramento are led farther southward by the Delta Cross Channel, from which they are lifted 197 feet by electrically driven pumps into the Delta Mendota Canal. The latter canal flows southward, on the west side of the San Joaquin River for a distance of about 100 miles, thus supplying the San Joaquin Valley with Sacramento River water.

Power is developed mainly at the Shasta Dam, which has a capacity of 375,000 kilowatts. The project will irrigate over 2,000,000 acres of land, besides accomplishing the other purposes stated above. The Central Valley project is indeed a multiple-purpose project. Its financial support will come mainly from the sale of water for irrigation, the sale of electric power, and government funds.

Coal Reserves. The total reserve of coal in the West is estimated to be nearly one-half that of the entire United States. It is true that much of it lies at great depth, and a large amount is lignite or subbituminous, paricularly in Wyoming, Montana, and Colorado (Figs. 21 and 187). Yet, expressed in terms of bituminous coal equivalent, it is further estimated that Wyoming leads all states with a reserve of 439.4 billion tons. The second-ranking state is North Dakota in the Great Plains with 293.4 billion tons, followed by Colorado and Montana with 284.9 and 200.5 billion tons, respectively. Washington and Utah have considerable reserves. Oregon's reserve is small, and California is practically without coal.

The coal of Colorado, Utah, and Wyoming supplements greatly the meager water-power resources in the middle Rocky Mountain area. Montana is the richest of the Rocky Mountain States in power resources, for, in addition to its large reserve of coal, it has a great water-power potential.[1]

In the future, when the coal reserves of other sections of the United States become depleted, these great reserves of the West will undoubtedly be worked and become important.

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[1] United States Department of Interior, Bureau of Mines, "Mineral Position of the United States in 1947."

Petroleum and Oil-Shale Resources. The great stock of oil in the Bakersfield and Los Angeles regions is called upon to supply fuel and power for the growing population, industries, and shipping of the West Coast, and to railroads extending into the interior. These reserves are fortunately located too, because of the lack of coal in California. Since about 1925 California has exceeded Oklahoma, and ranked second to Texas, as the country's greatest oil producer (Figs. 25 and 27).

There have been significant developments of oil fields in Montana, Wyoming, Colorado, and New Mexico. In 1950, Montana produced 60,467,000 barrels of oil, placing it seventh in rank among the states in petroleum.

It is impossible to state what the national reserve of petroleum is, much less that of the oil shales of the West. Of the latter the West has the largest reserves in the country. One estimate gives 75,000,000,000 barrels as the possible reserve in the oil shales of the Rocky Mountains, a large part of which lies in northwestern Colorado and northeastern Utah. Up to the present this reserve has not been levied on, because of the high cost of extraction. In the future, when the petroleum supply becomes more nearly exhausted, these oil-shale reserves may be tapped.

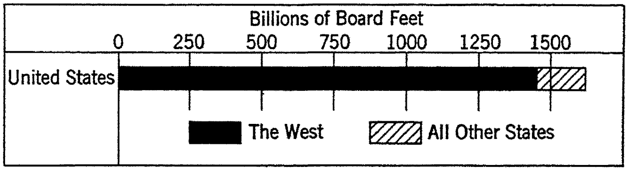


Fig. 188. Forest reserves of the United States and the West compared.

The West has power, therefore, far in excess of its needs for a long time to come. It has been shown that water-power development has now exceeded the local demand, and the West invites industries to come to the supply. The coal production in the West in 1950 was 21,400,000 tons, out of a total of 560,388,000 tons for the United States. Much of the Western coal is used on the railroads.

Raw Products for Manufacturing. The Western States have great quantities of a few raw products that must undergo some manufacture in preparation for the market, which is largely in the Eastern States. Foremost among these primary manufactures are those turning out forest products, canned fruit and vegetables, fish, flour, and sugar, and the precious, semiprecious and more useful metals.

The Commercial Forests of the West. The distribution of the forests of the West has been noted. In the Pacific Northwest occur the heaviest forest stands in North America, and the three coastal states now contain about 62 per cent of the remaining saw timber of the United States (Fig. 188, also Figs. 28–32). In 1950, the 11 Western States furnished almost one-half of the lumber cut of the country (Fig. 189). The lumber cut was 35,404,000,000 board feet for the United States, and 16,278,000,000 board feet for the West. Oregon was far in the lead as the nation's greatest lumbering state; and Washington, Oregon, and California produced nearly 90 per cent of the lumber cut of the West.

Because of the economic youth of the West and the great distance from the large timber markets, the slaughter of the forests has been much less than in the eastern part of the country, thus accouning for the high percentage of remaining saw timber in the West.

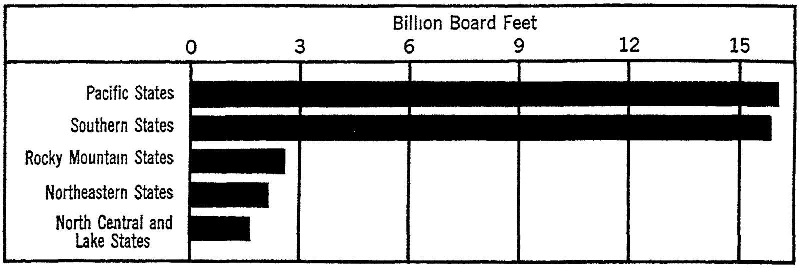


Fig. 189. Lumber production by regions in the United States in 1950.

The Lumber Industry in the Northwest. Although the first commercial sawmill in Oregon was constructed in 1844, and the first on Puget Sound in 1845, the lumber industry in the Pacific Northwest was of little importance until after the discovery of gold in California. Fifty or more years before this date, timber had been cut at various places along the coast for the construction of ships engaged in the Pacific trade, but it was not until the "Gold Rush" brought thousands of people to the semiarid regions in the lower Sacramento and to San Francisco that there was a demand for the timber of the coast lands of Washington, Oregon, and northern California. A market was also developed in the Hawaiian Islands. Many New Englanders, some from the lumber regions of Maine, came in ships around the Horn with complete logging and sawmill equipment and began the slaughter of the forests, the lumber being sent by vessel to the San Francisco Bay ports.

For thirty or forty years after this, the development of settlements in the Northwest was slow and the demands for lumber were limited. Besides, home builders of the Prairie States and the Great Plains looked to the sawmills of the Great Lakes and upper Mississippi for lumber; but, with the decline of lumbering in the Middle West and the building of

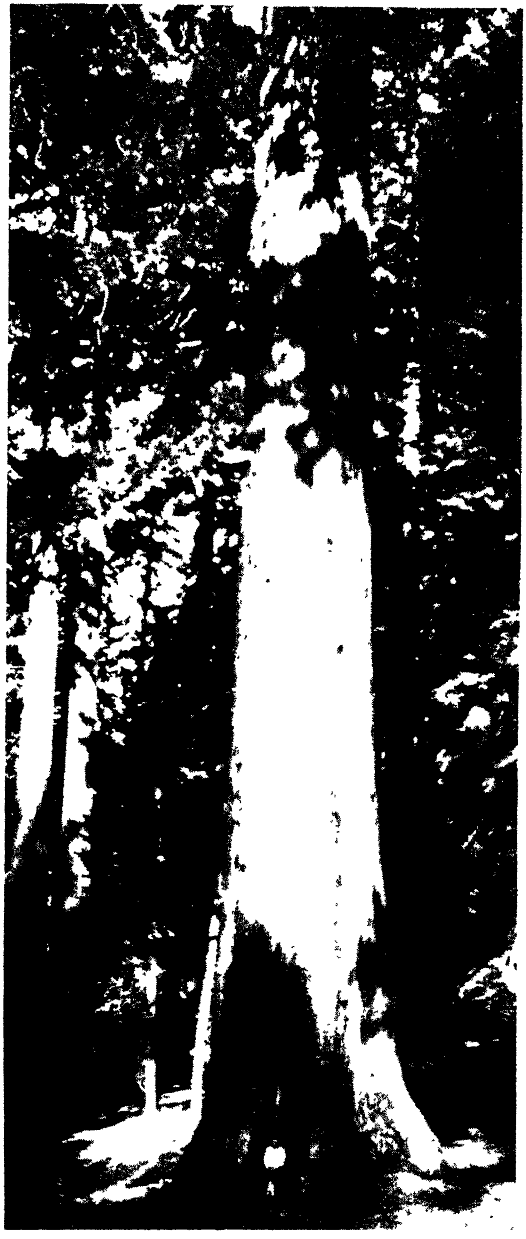


Fig. 190. Scene in the redwood forest of western California. This is a unique tree in that it has a very restricted range. It is rarely found above 3500 feet altitude, and generally grows in valleys and sheltered places on coastal plains within 25 miles of the ocean where there is a constant moisture-laden air. It produces a great amount of lumber per tree. *Photo by Miller.*

railroads eastward from Portland and the Puget Sound cities, a greatly expanded market was opened up, and the Pacific Northwest began its rise as a lumber region, the most rapid rise being since the early 1880's. By 1885 there were 228 mills in operation in these two states. By 1910 this region had surpassed the Great Lakes states and the Northeastern States in amount of output, and by 1929 it had surpassed the Southern States.

The largest and best-equipped mills in the world today are to be found in the Pacific Coast lumber towns. This is due primarily to past experiences in the lumber industry and abundant capital from the East. When the industry started, Oregon was most active because it was first settled, but accessibility to the forests bordering the long shore line of Puget Sound soon gave Washington the lead. By 1939 the forests close to the Sound were being depleted, and timber farther from its shore were difficult to get because of the large sizes of trees, and the rough terrain. In that year Oregon took the lead again over Washington as the leading lumber producer, perhaps because of the use of the Columbia River for both logging and navigation.

The principal timber species of the Pacific Coast are the Douglas fir, cedar, spruce, red fir, yellow fir, and Oregon pine. About 25 per cent of the lumber cut in the United States in board feet is Douglas fir. It is claimed that the existing stand of this species is about 27 per cent of the standing timber of the United States, including both hardwood and softwood, and that there are 400,000 million board feet of Douglas fir west of the Cascades. It is the dominant forest tree in the Pacific Northwest, making up in some tracts which have been examined carefully 92 per cent of the stand. It is difficult for one to visualize the tremendous amount of timber on an acre unless one has traveled through these forests.

Another much-advertised species of the Northwest is the redwood, confined to a small area in northwestern California, mainly north of San Francisco Bay, and in southwestern Oregon (Fig. 190).

The large size of the timber, the great density of the stand, the lack of snow and ice, the relatively small volume of water in the mountain streams, and the roughness of the topography of much of the forested areas all offered new problems for the lumberman to solve. New methods of logging, transportation, and manufacture, vastly different from those in the East, had to be devised.

The sawmills of the Rockies and the Colorado Plateau are not so large or efficient as those of the Pacific Northwest. Logging is easier, but the timber is small and scattered, and the waste in lumbering and manufacturing relatively greater than with the "big" trees.

In northern Arizona considerable lumber comes from the National Forests. The chief species are Douglas fir, western yellow pine, and spruce. The most important logging operations are concentrated around Flagstaff and Williams. In Montana the lumbering centers are Missoula, Polson, and Kalispell. In Oregon the chief mill town and shipping center for lumber is Portland; in Washington, Longview on the Columbia and Seattle and Tacoma on the Sound are great centers (Fig. 191). At Tacoma are mills that not only produce lumber but also plywood, pulp, paper, and various other wood products. Seattle is one of the leading lumber-producing and export points of the world. In northern California, McCloud and Susanville are important centers. At Susanville, wood products used in packing fruits and vegetables are turned out in great quantity (Fig. 192).

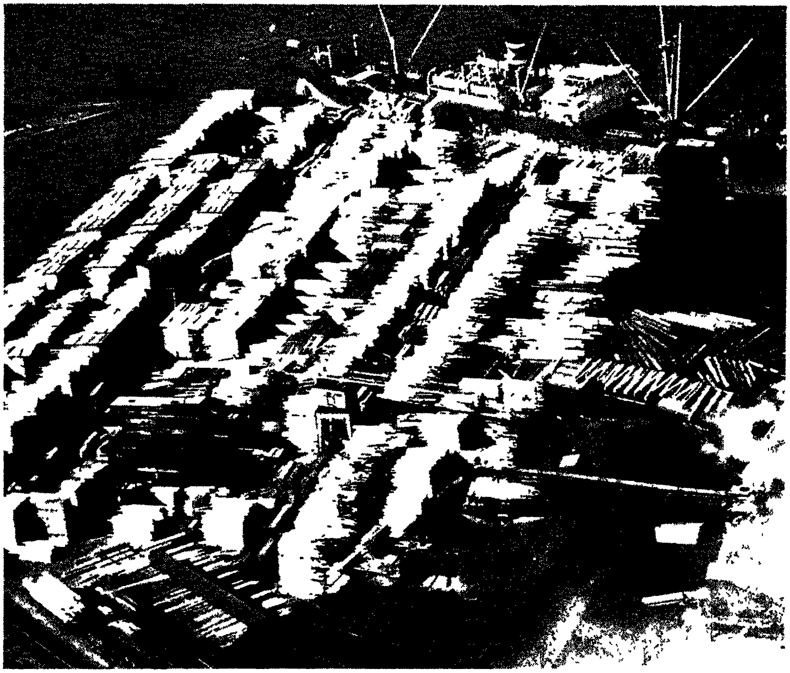


Fig. 191. Tacoma harbor showing lumber stacked for shipment. *Courtesy, Tacoma Chamber of Commerce.*

The West has always had a large home market for its timber products, in building material, props used in mines, and for firewood. But the market has developed broadly. It now covers the entire United States, except perhaps parts of Maine and some of the Southern States, also Australia, China, Japan, Hawaii, and the west coast of South America, Mexico, and Central America. The railroads extending eastward from the Pacific

Northwest have aided the industry greatly by granting low freight rates. Even today a large bulk of the east-bound freight consists of lumber and wood products. Lath and shingles from Portland, northern California, and Puget Sound sawmills are large exports. The West Coast States produce more than two-thirds of the laths turned out in the United States and nearly all the wooden shingles, which come mostly from red cedar. There is an increasing development of the woodpulp industry in the Puget Sound region, where numerous mills are located. A considerable amount is exported, but there is a growth in the paper-making industry. There is an unlimited supply of clear water and power for the paper-making business, but the limited market in the West handicaps this industry. Tacoma is the leading center for pulp and paper manufacture. Seattle has a furniture-manufacturing industry of considerable importance.

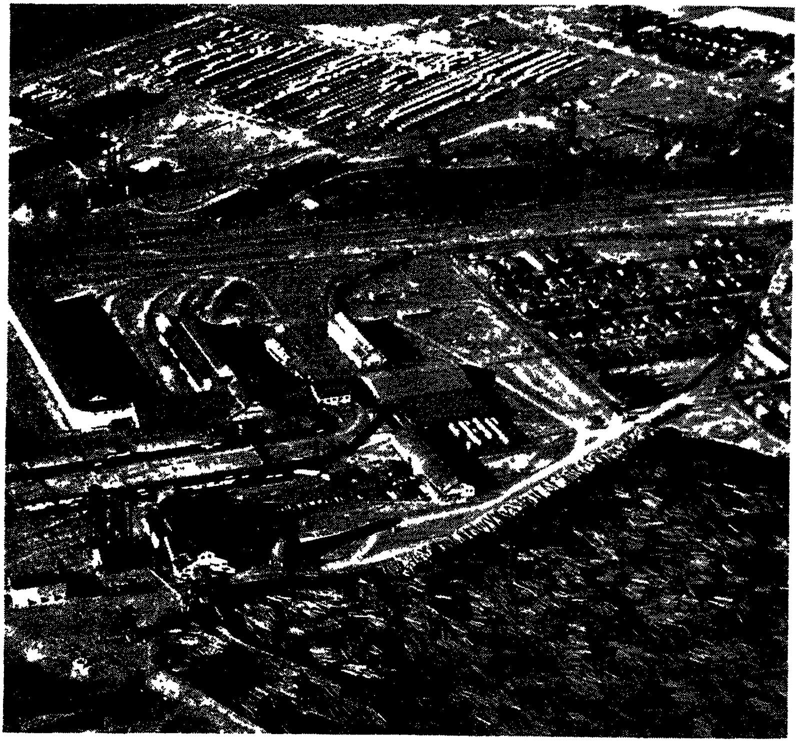


Fig. 192. Mill facilities of fruit growers' supply at Susanville, California. This supply organization owns forests and operates mills for making boxes and crates used in marketing fruits and vegetables. *Courtesy, Eastman Studios, Susanville, California, and Fruit Growers' Association.*

The conservationist is well aware of the watershed function of western forests, but too frequently lumbering is practiced in such a way as to result in erosion, rapid run-off, floods, and sedimentation that do great and irreparable harm to western lands in general. Perhaps in no section of the country is the necessity to control lumbering on watersheds so great as in the West. The numerous National Parks and Forests of the West are located usually in areas that are sources of drainage and hence serve as controls of run-off.

CANNING, PRESERVING, AND DRYING INDUSTRY

The long distance from the great markets of the country and the "off-season" demand for fruits and vegetables are the chief reasons for the prominence of the western states in the canning and drying of fruits and vegetables. The net value of this industry in 1950 was over $225,000,000. Only five Western States are active in this industry—Washington, Oregon, California, Idaho, and Utah—yet they produced about 33 per cent of the canned fruits and vegetables of the country in 1950. The canneries of California are not only the most numerous but they are the most active of any state. They produced nearly three times as much, by value, as the canneries of New Jersey, the second state in rank. Apricots, peaches, and pears are the chief fruits canned in California, and berries in Washington and Oregon.

Since about 1930 the Pacific Coast States have been preparing juices for eastern markets. An increasing amount of the product of both oranges and lemons is going into juices frozen for the market. This industry serves as an economical market outlet for large crops (Fig. 193).

One fruit little known in the East until its introduction as a fruit juice is the loganberry, a hybrid of a raspberry and a blackberry, discovered by Judge James H. Logan in his garden in Oakland in 1882. The berry was given to the University of California for distribution to fruit growers of California. The center of production of loganberry juice is in Oregon and Washington. The boysenberry and other hybrids are canned. Refrigerated berries for distant markets are also shipped. Formerly the berries were packed in barrels and frozen for use in eastern markets. Now, along with other fruits and vegetables, they are wrapped for retail trade in small packages, then frozen for shipment. The general use of "quick-freeze" equipment has widened this market. There is also much canning of loganberries and other berries in Washington and Oregon. Since about 1930, tomato canning has increased, particularly in California. This state, together with Maryland, produced about one-half of the canned tomatoes of the country in 1950.

The products of western canneries are to be found in most groceries of the country.

Rainless summers and late autumns with bright sunlight and low humidity make California a natural region for the drying of fruits. Nearly all the dried raisins, peaches, and apricots consumed in the United States come from California, and this state produces practically all the dried prunes, and more than a third of the dried apples. The major part of the canning and preserving of fruits and vegetables in the West is carried on in the smaller towns, and near the berry patches, orchards, and gardens. Nearly everywhere in irrigated areas of the West, where fruits and vegetables are grown, the small canning and preserving plant is a feature of the landscape. Most of the plants are cooperatively owned and operated. The products are manufactured under the best of sanitary conditions, and the raw materials used are carefully selected. The output is of the highest grade, for only a high-grade product can compete in eastern markets with eastern-manufactured goods.

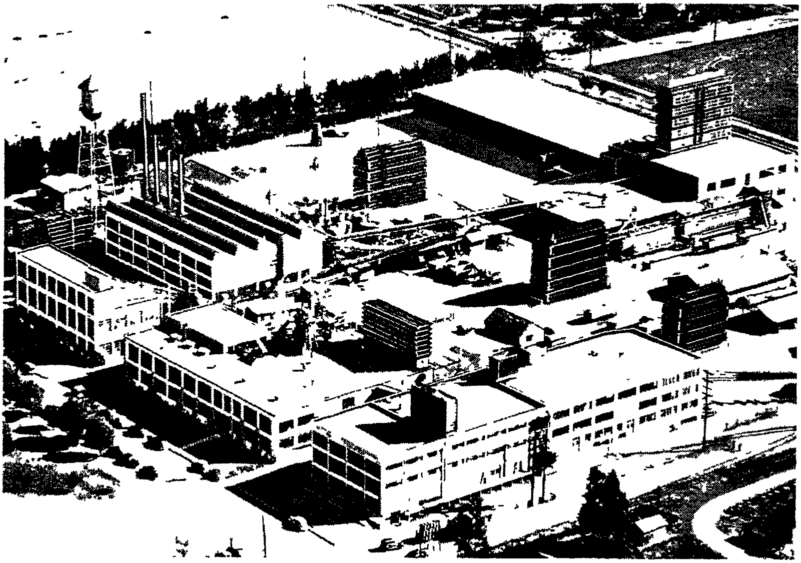


Fig. 193. Plant of the Exchange Orange Products Company, Ontario, California. This wholly owned subsidiary of the California Fruit Growers' Exchange manufactures various products from oranges. A similar plant is located at Corona, California, for handling lemon products—juice, lemon oil, citric acid, pectin, and dried citrous peel for stock feed. *Courtesy, California Fruit Growers' Exchange.*

Raisin drying is done in the vineyards, and only in a loose way may it be considered a type of manufacture. Fresno is the great center of this industry. Raisin-grape growing in California was first attempted in the southern part of the state where grape culture had been practiced since the early Spanish days. Raisins are still produced in large quantities in the San Bernardino Valley and nearby irrigated areas, but after the spread of the raisin-grape culture to the San Joaquin Valley it was discovered that the Fresno district—including parts of the five counties—offered better geographic conditions than southern California, and in time Fresno assumed leadership. It was not until the early 1880's that the raisin industry began to attract much attention, even in California. In 1879, a little more than 1,000,000 pounds of raisins were produced, but by 1886 the output reached 14,000,000 pounds and California raisins began to compete with the Spanish product in eastern markets of the United States. By 1892, the California crop equaled that of Spain, and the raisin imports of the United States from Spain were reduced fully 20 per cent. Since about 1940 the United States crop has been over 300,000,000 pounds. The California Associated Raisin Company, which handles about 85 per cent of the California crop, is a cooperative organization that attempts to adjust production to market demands. Besides carrying on an active advertising campaign in the United States to educate the American public to a greater appreciation of the food value of raisins, with the hope of increasing the per capita consumption, it is developing foreign markets. California raisins now go to Canada, many countries of South America, and the Orient.

In still another field in canning the West is active. In 1950 the output of canned and preserved fish from the plants of the Pacific Coast states was valued at more than $175,000,000 (product shipped). The three Pacific Coast States produced 70 per cent of the canned and preserved fish, crab, shrimp, oysters, and clams, of the United States in 1950. A wide variety of fish is processed in the canneries of California, but salmon is the most important fish used in the canneries of Washington and Oregon. The canneries of necessity are located near the fisheries.

OTHER INDUSTRIES

In many of the irrigated regions condensed or evaporated milk is a product, and one of the largest milk-condensing plants of the West is in the Puget Sound Trough.

Much of the wheat of Oregon, California, Washington, and other Western States goes to the flour mills of Seattle, Tacoma, and San Francisco Bay cities. Some of the export flour of these mills finds a market in China and Japan. Portland is the leading flour-mill city, since it has easy access to the wheat fields of eastern Washington and Oregon. The Columbia River Valley offers lower railroad grades than are found across the Cascades. Spokane is a great wheat-milling center in eastern Washington, and wheat flour from Ogden, Utah, has long been known in the West.

Beet sugar factories are numerous in the northern and central parts of the West. In 1951 Colorado had 17, Utah 6, California 12, Montana 6, and Washington 2. The value of beet sugar in the United States in 1951 was approximately $270,000,000, and that for the 11 Western States represented $210,000,000, or about 75 per cent. California and Colorado were the leading states in beet-sugar production. California also ranks high in cane-sugar production, Hawaii furnishing the raw sugar. Refineries are located in the San Francisco Bay area.

The northwest has become nationally known in furniture manufacturing. The Douglas fir and some hardwoods furnish the lumber, though, strange to say, some importing of walnut, Philippine mahogany, and others hardwoods is done, for veneer and panel manufacturing. Portland and Tacoma are the chief centers, but furniture is also made in Los Angeles, San Francisco, and in a few other places. The market is largely local.

Rapid strides have been made since about 1930 in the manufacture of textiles and clothing. Wool has been important in the Willamette Valley since early days. Now this product reaches Portland from the Rocky Mountains and other interior locations, making this port the largest wool market in the country. Clothing manufacture centered at Portland and Seattle was for a long time, devoted mainly to lumbermen's wear, overalls, jackets, sweaters, and women's dresses. The coming of tourists has caused the industry to expand to sportswear. Although the manufacture of clothing in the Northwest has a national reputation, the major market is at home.

San Francisco and the Bay cities have considerable clothing manufacture, but Los Angeles now is recognized as one of the leading centers of the country, particularly for style in clothing. Cotton of southern California and the Southwest supply some of the raw product, but much is imported. The influence of Hollywood and motion-picture stars has resulted in much attention to style, so that Los Angeles is now thought of as a clothing style center along with Paris and New York. Also sportswear and all kinds of outdoor wear are emphasized in the Los Angeles clothing industries, and more attention is given to women's and children's wear than to that of men.

MINING AND METAL MANUFACTURING

Mining has long been one of the leading industries of the West, and the products of the mine are the basis of an active smelting and refining business.

The Iron and Steel Industry. The iron ore reserves of the West are in Utah, Wyoming, California, and some in Colorado. Those of Utah and Wyoming have been worked for some time, and the amount of the reserve may be considerable, though it is not known. The reserves in the San Bernardino Mountains are small, and in no other localities of the West are iron ores known to exist in any great quantities. For a considerable time Pueblo, Colorado, was the only iron and steel city of the West. It has imported much iron ore, but has drawn some from more local ores in Utah and Wyoming, and uses coal mined near Trinidad, Colorado. Its market has been largely steel for railways and mining machinery. The market for iron and steel, in general, improves in the West as population increases, but World War II brought such an increase in demand that refining and smelting made much progress at Provo and Geneva, Utah, using ore and coal from nearby. Also the great demand for steel in the fast-growing industrial areas of Los Angeles, the Bay cities, and in the Puget Sound, which are far removed from the eastern sources of steel, resulted in a beginning of iron ore refining and steel making at Fontana and Pittsburg in Southern California, using ores from the San Bernardino mountains. Particularly during the war emergency, all western iron and steel industries made much use of scrap iron, and gave attention to beneficiation of iron ores produced locally. The production of vanadium and uranium was stimulated in Nevada, particularly from the Colorado and Utah ores. These metals have an important significance because of their uses—vanadium in the processing of steel and uranium in the development of atomic energy. Taken as a whole, the steel industry in the West is small indeed compared with that of the Pittsburgh, Pennsylvania, area.

Petroleum Refining. California, as we have seen, is active in the production of petroleum, ranking second among the states. The output of the refineries is approximately 15 per cent of the output of the country. New Jersey refines 8 per cent of the product of the United States, and Texas nearly 27 per cent. These are the three leading states, Texas having gained much since about 1930.

The industry in the West is largely of recent development, following the great advance made in the production of petroleum, and the stimulus of the war years. The entire West and many countries bordering the Pacific are the markets for the output of the refineries. Oil-burning locomotives, stationary steam engines, internal-combustion engines, oil-burning ships, and airplanes consume large quantities of fuel oil. The refineries at Bakersfield, California, produce high-octane gasoline, so important in airplane service. However, most of the petroleum is refined in the coastal refineries of southern California, mainly in the Los Angeles region, not far from the producing wells.

The Importance of Non-Ferrous Minerals. The metallic, and particularly the non-ferrous metallic, minerals make the Western States one of the greatest mineral regions of the world. Most of the ores are manufactured into metals before shipment for secondary manufacture. The East with its immense markets is the destination of most of the more useful metals, such as copper, lead, and zinc. Here they are used in making hundreds of manufactured articles that command a high price.

The ores of the more important metals occurring in paying quantities for mining in Western States are copper, zinc, lead, gold, silver, platinum, mercury, nickel, bismuth, chrome iron, antimony, and tungsten. Of these copper, zinc, lead, gold, and silver are the most widely distributed, being found in most of the states. Some of these deposits occur as native metal, but most of the ores are chemical compounds that generally occur in a rock matrix called gangue from which they are separated with difficulty. Placer gold is the most common of the minerals that occur as native metals. The first process in the treatment of ores is to separate them from the gangue. Because most of the ores are heavier than the gangue, stamp mills, or concentrators, using crushing machinery, water, and gravity, are common. There is a tendency for the concentration plants to be near the mines to save the expense of hauling worthless rock, yet a large supply of water is a prime requisite. After concentration comes the smelting process, which turns out the metal in a crude form. It often happens that the metal from the smelter is not pure, but may have considerable amounts of other metals combined. For instance, the so-called copper from the smelter may have gold and silver in it. In order to recover the gold and silver, as well as to have a refined copper, a third process—refining—is necessary. Refining is a highly technical business, generally done by the electrolysis method, which breaks down the chemical elements in a substance and requires a great amount of inexpensive electricity if it is to be done economically. For this reason, refineries are frequently located on water-power sites and use hydro-electric power. It thus works out that there are fewer refineries in the West than smelters, and fewer smelters than concentration plants. The important copper refineries in the West are at El Paso, Texas, Great Falls, Montana, Tacoma, Washington, Inspiration, Arizona, and Garfield, Utah. Thus the manufacture of metals, if such it may be called, in the West consists of mining and conditioning the raw product so that it may be transported economically to other manufacturing centers that have abundance of labor, management, and accessible markets.

Mining and Metallurgical Districts. Complete data that would give one the quantitative distribution of smelting and refining in the West are lacking, for many companies deem it necessary to keep the extent of their operations a secret (Fig. 194). We know that Arizona, Nevada, Montana, and Utah are the leading western states in smelting and refining. California continues to lead in the production of gold but is not active in its primary manufacture.

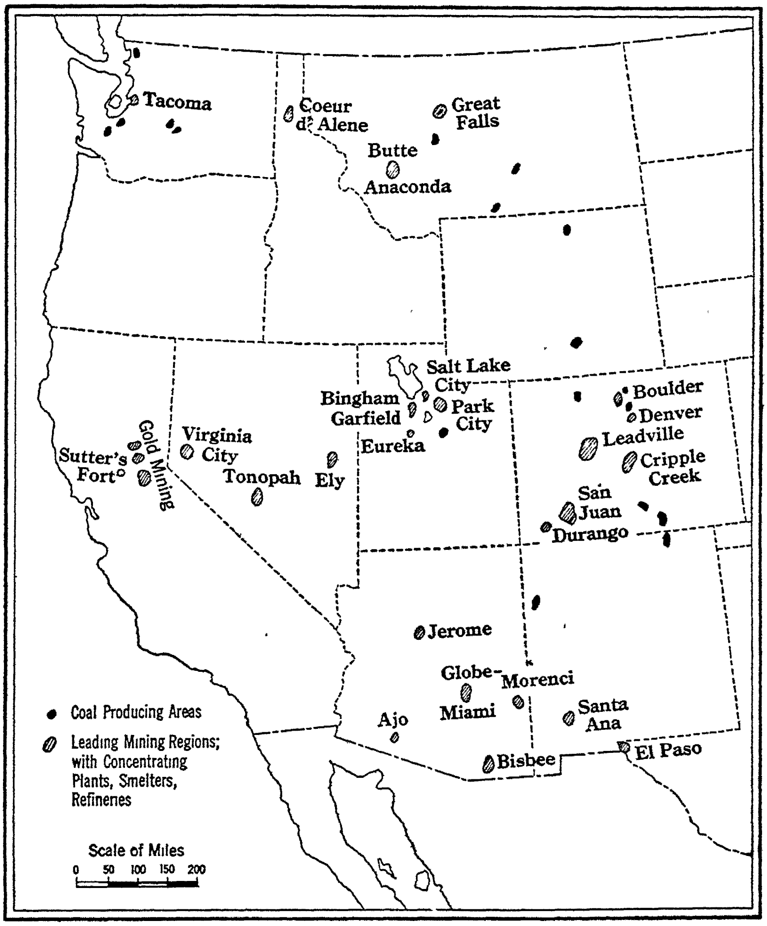


Fig. 194. The leading mineral regions of the West.

The Arizona District. Arizona probably has the largest smelter output of copper among the Western States, the production, measured in pounds of fine copper, being several times that of Montana, its strongest western competitor. New Jersey has been and still is, however, the leading state in the Union in copper manufacture. The leading copper-mining region of Arizona is in the southeastern and central parts of the state, the Bisbee, Jerome, Morencia, Metcalf, and Globe-Miami districts. Bisbee is the most important. The Arizona Copper Company has a large smelter at Clifton near the Morenci mine. As early as 1738, silver nuggets were found in the gravel of some streams in Arizona and, as stated earlier, gold was found in the channels of the Gila and Colorado Rivers. Tombstone was once an active gold-mining camp, but gold mining has long since given way to the mining and metallurgy of copper.

The Butte Region. The Butte area of Montana is considered one of the greatest mining centers in America if not in the world. Since 1940 it has been surpassed only by Bingham, Utah. Much more than a billion dollars' worth of metallic ores have been taken from the ground. The mines fairly honeycomb the hills on which Butte and other nearby towns are built, and scattered through the urban centers are tall smokestacks, steel hoist frames, machine shops, dingy mine buildings, railway yards, and all the accompaniments of deep mining. The first smelter erected in Butte was completed in 1800. In 1883 the Anaconda Copper Company began the construction of what is probably the largest smelter in the world, in Deer Lodge Valley, about 27 miles from Butte. Here grew up the city of Anaconda. The capacity of this great plant is about 12,000 tons of ore a day. A smaller smelter has been erected at Great Falls on the Missouri.

The once-active smelting industry at Butte has declined, but the former activity is read in the great number of dead trees and shrubs, destroyed by the acid fumes from the great smokestacks; even the soil was poisoned for plant life and it is only recently that vegetation is getting a fresh start. A similar destruction was begun at Anaconda, but the company a few years ago was forced to put in a by-product plant. Sulfuric acid is now produced, and reaches the eastern markets, when the price is high enough to pay the heavy freight charges.

The Butte region copper is shipped to Great Falls for refining where cheap hydroelectric power is available.

The Utah District. Mineral prospecting in Utah was delayed for many years by the adverse attitude of the Mormon Church, but in 1863 soldiers of the United States Army, stationed at Fort Douglas, discovered valuable ores in Bingham Canyon. Copper was first shipped in 1868, the first lot going to Baltimore, Maryland, since there were no smelters in the

West. Bingham today has the largest single mine in the world (Fig. 195). The ore outcrops on the side of a gulch, the face of which is 1600 feet high, and is mined at a very low cost by electric shovels working on many levels. Over 50,000,000 tons of ore have already been removed, and exploratory drilling indicates a reserve of nearly 400,000,000 tons.

There are two large concentrating plants at Garfield, the larger covering 20 acres. From the concentrating plants the "enriched" ore is taken to the smelter just to the west of Garfield. There are smelters also at Murray and Midvale, suburbs of Salt Lake City, and at Milford and Ogden.

Park City, on the east slope of the Wasatch, is another great mining district, the rock here carrying silver, lead, zinc, gold, and copper. It is one of the leading silver producers of the nation. The Tintic Mountains, to the southwest of Utah Lake, have deposits of silver and lead.

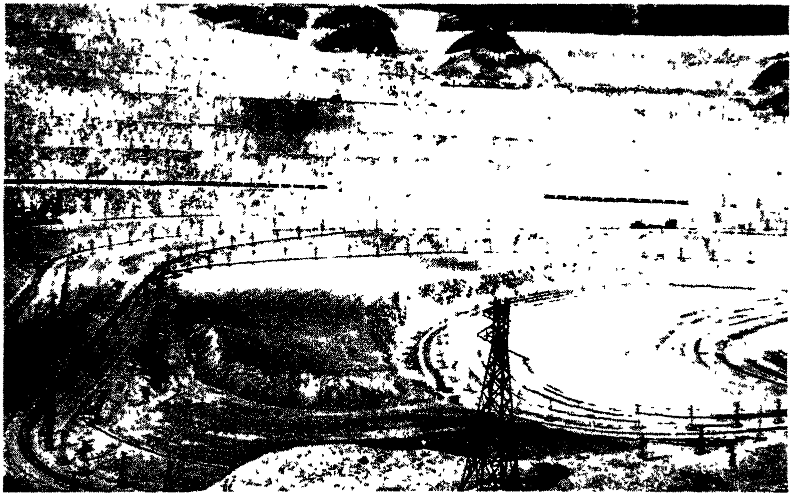


Fig. 195. Bingham Mines in Utah. This open-pin mine is one of the most spectacular views of the mining world. Electric shovels and trains operate on some fifteen or twenty levels. By numerous switchbacks and horseshoe curves, the ore cars carry ore from all levels to the village of Bingham below in the canyon, and out to Garfield for concentration and smelting. *Photo by Miller.*

The Idaho District. The Coeur d' Alene district lies in northern Idaho and has become one of the richest mining areas of the Northern Rocky Mountains. It produces silver and zinc, and about one-fourth of the nation's lead. The ores are complex and difficult to recover, but new processes and industrial expansion in the Northwest have operated to improve this industry in its isolated location.

The Leadville District. The Leadville mining and smelting district is remarkable in its variety of minerals. Gold, discovered by prospectors in the boulders and sand deposits of California Gulch, attracted hundreds of miners in 1860 and resulted in the founding of Ore City, which in less than a year had 10,000 people.

The history of this city shows how short-lived is a community built up entirely because of mineral deposits, particularly on precious and semiprecious minerals. Ore City began as a gold camp in 1860, became a silver-lead-producing area in 1879, and, after the decline of these industries, became a lead- and zinc-producing region. Ore City continues to produce gold, silver, and lead, but zinc leads. Copper began to be mined about 1889 but only in small amounts. Local copper smelters work up much of the copper ore of the area. Iron, manganese, and bismuth are also found. There are several smelters at Leadville, but not all the primary manufacture is done here, some ore being sent to Pueblo and Denver (Fig. 196).

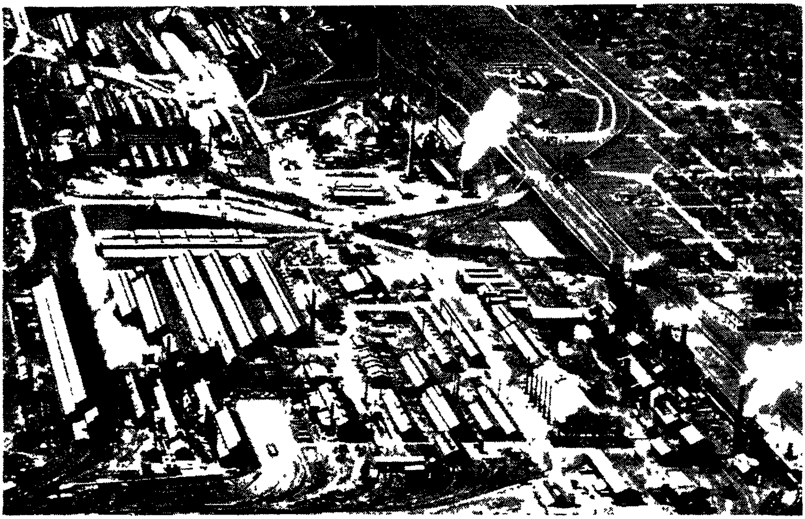


Fig. 196. Pueblo, Colorado—"Steel City of the West." Nearness to the coal at Trinidad, Colorado, and iron ores in Utah and northern Colorado has been the chief advantage of this location for steel making. Railroads have been the chief market for steel rails made here. *Courtesy, Pueblo Chamber of Commerce.*

The adoption of a bimetal standard of money would greatly stimulate the mining industry of the West. Gold, silver, copper, zinc, and lead are frequently found mixed in the veins. This intimate mixing makes the cost of extracting any one metal expensive.

Leadville is still an important producer of lead and zinc, but since the 1930's it has become most important for molybdenum mined at Fremont Pass, 13 miles to the north. Here is located the world's most valuable deposit of molybdenum. It is said to contsitute 95 per cent of the world's known reserve, and from it the United States produces 66 per cent of the world's supply. This metal gives toughness and fatigue strength in alloys with iron and steel used in machine tools and motors for automobiles and airplanes. The United States makes great use of this mine.

Historic Mining Towns in Colorado. But few of the mining towns that date from the "gold fever days" have been as successful as Leadville in holding a place in the mining world. Many a "Queen of the Rockies" of the 1850's, 1860's, and 1870's is now wholly deserted. The number of public buildings, schools, stores, churches, and the inevitable saloons and dance halls with weathered exteriors, sagging roofs, broken windows, and gaping doors are indicative of the number of people, gathered from every quarter of the globe, that called these towns home. Among the larger historic towns are Carbondale, in western Colorado, Bachelor, Teller, Robinson, American City, Pearl, Nevadaville, Lulea, Tincup, Gothic, and Montezuma.

Other Districts in Colorado. Cripple Creek has a smelter and cyanide extracting plants for treating copper, silver, and gold ore,but most of the ore is sent elsewhere. The San Juan district in southwestern Colorado, about the cities of Telluride, Silverton, and Ouray, produces gold and silver. Ore-reducing plants are located at Durango and Salida, and smelting is done at Leadville. Pueblo is an iron-smelting and steel center. The numerous railroads that pass through the city bring ores from the mountain valleys and carry the smelter products eastward to the Atlantic seaboard states for further manufacture.

The Nevada District. Mining and the primary manufacture of ores are the chief activities of the people of Nevada. At present, about 90 per cent of the ore mined is refined in the state, but the metal obtained is sent elsewhere for further manufacture. The Comstock Lode, near Virginia City, as earlier stated, furnished the first silver and gold ore for refining.

Mining here has been a great gamble, for the veins vary greatly in richness; in some places the rock yields several thousands of dollars a ton; in others, very little. Since before 1880, the miners near Virginia City, and consequently the output of the concentrating and refining works, have been declining. The great importace of this mineral region in the economic life of the state is indicated in the decline of population. In 1880 the population of Nevada was more than 62,000; in 1900, a little more than 42,000. Subsequent discoveries of gold, silver, and copper deposits in the Goldfield-Tonapah district and in other districts both to the north and south, a slight increase in the output of the Comstock mines, and continued activity in the eastern part of the state brought prosperity for a time, and the population increased to nearly 82,000 in 1910, but fell to

77,000 in 1920. In 1927 gold was found at Weepah, and a "rush," bearing many of the characteristics of former days, was on. In 1950 the population of Nevada was 160,000. The population growth was given a great impetus again by increased mining and the metallurgical and other war industries at Las Vegas. The most active section of the state today in the metal industry is in the Ely district in eastern Nevada. Here is produced about 98 per cent of the copper of the state, besides lead and zinc. Concentrators and smelters prepare the metals, chiefly copper, for shipment. Lead ore is sent to Salt Lake City, and zinc ore to Iola, Kansas. A very large cyanide mill was erected near Virginia City for treating the low-grade ore of the Comstock Lode; thus this great deposit, which is credited with having yielded more than $400,000,000 worth of gold, is further to enrich its owners.

The Black Hills Mining Region. The major metallic mining region of the Great Plains is in the Black Hills of South Dakota. Small quantities of various minerals have been produced here, such as silver, lead, copper, and tin, but gold is the most important. The famous Homestake mine with its associated refineries is located at Lead, South Dakota, and constitutes the largest single gold producer in the United States, if not in all the world. It stimulated the "gold rush" to the Black Hills in the 1870's, and has operated continuously since.

AUTOMOBILE ASSEMBLY AND AIRCRAFT INDUSTRIES

The practice of assemblying automobiles in regions far from the area of manufacture in the Lower Lakes Region has grown much since about 1930. In general it is less expensive to transport the parts of the automobile than to transport the finished product; consequently assembly plants have been located in many large cities throughout the country. In the West, the large centers for this business are the San Francisco Bay area and Los Angeles, Los Angeles being the largest in the West. Although the assembly industry is not truly manufacture, it employs great numbers of men, and brings about manufacturing of small parts, and in related fields. The great increase in population in the West, and hence increase in the market for automobiles, has stimulated the assembly industry. California now has a greater number of registered automobiles than any state in the Union. In the manufacture of rubber tires for the automobile, the plane, and other uses, Los Angeles is becoming a rival of Akron, Ohio, as the "Rubber Capital."

In the manufacture of aircraft Los Angeles has for a long time been the leading center in the country. The mildness of the climate, clear skies, and available space for the enormous assembly hangars have been cited as factors attracting this industry. Seattle is another center in the West important in this industry though the climatic conditions have not been so favorable. The advantage of an early start has seemed to fix the industry in Seattle (Fig. 197). During the World War II years, the shortage of labor in the West, and the urge to shift the aircraft industry inland to places less vulnerable to attack by an enemy has resulted in a dispersal of the aircraft manufacturing to the East and East Central States. Wichita, Kansas, and Fort Worth, Texas, developed and maintain large aircraft industries; however, the Los Angeles area continues to hold a prominent position as a leader in the industry.

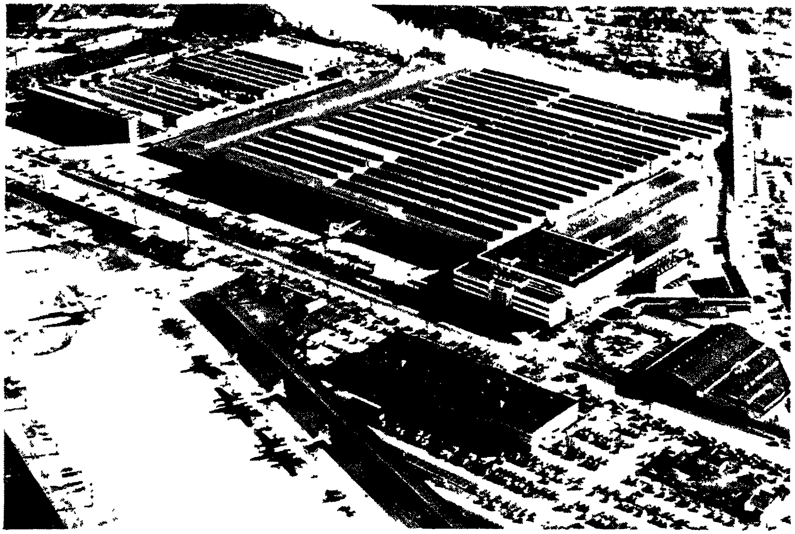


Fig. 197. The Boeing Airplane Company at Seattle, Washington. This plant is the company's chief facility. It includes an assembly building, the plant proper, engineering laboratories, and administration quarters. This was the home of the World War II B-17's and the major assembly facilities for B-29's. *Courtesy, Seattle Chamber of Commerce.*

Los Angeles, the Bay cities, and Puget Sound cities all have important airplane landing fields, and these cities serve as termini for airliners from the East. San Francisco is the chief take-off point for Hawaii and cross-Pacific flying. The landing field at Alameda, on San Francisco Bay, is said to be one of the largest in the world.

THE FISHING INDUSTRY

The Pacific Coast as a section has led all others of the nation in fisheries since about 1940. In the period 1940-1949 the average annual number of fishermen employed was 30,000, the catch was 1,300,000,000 pounds, valued at almost $80,000,000. In the same period the corresponding annual averages for the historic New England section, long noted for its fisheries, were 25,000 fishermen, with a catch of 850,000,000 pounds, valued at $51,000,000.

In the Pacific Northwest salmon is the chief fish caught. The Columbia River, the Puget Sound, and the coastal waters to Alaska constitute the main fishing grounds. Since about 1930 the catch of salmon has decreased, but that of halibut, herring, tuna, oysters, and others has increased. Unlike the New England fisheries, most of the fish are taken in coastal waters and at the exits of streams, and most of the fish are canned. Canning is done in the ports near the catch, and consequently many of the towns in Puget Sound and on the coasts of Washington and Oregon have canneries. Important ones are Astoria, Aberdeen, Port Angeles, and Bellingham. Because of the habits of salmon in running upstream to spawn, the pollution of waters by man, building of dams, and overfishing during the "runs" have resulted in such a decrease of salmon as to threaten the future of this fish. Conservation measures are being applied in many ways to protect the salmon.

Both halibut and tuna fishing have increased since 1930 on the north Pacific Coast. Much of the halibut is marketed in the East as frozen fresh fish. Also, a million-dollar-a-year oyster-fishing industry is located in Willapa Bay on the Washington coast. Aberdeen is the oyster canning center.

Seattle profits greatly from the fishing industry because it is the chief home port of the fishing fleet for North Pacific waters, including also much of the Canadian coast and Alaska. Vessels are outfitted here, and many vessels leave with a supply of tin for cans, to be put into proper form for canning of fish in the ports near where the fish are caught in northern coastal waters. The fleet returns laden with fish, a large part of it canned; so Seattle becomes the distributing point for fish to markets. This port is one of the world's greatest distributing points for fish.

Since about 1935 southern California has become an important fishing region. Tuna and sardines are the chief fish caught. Tuna fishing grounds are alongshore south to Mexico, Central America, and as far as the equator, and westward as far as Hawaii. Large vessels are necessary because the tuna must be frozen on board soon after being caught, thus preserving them for the canneries on shore when the vessels return. San Diego and Los Angeles are the canning centers and homes of fishing fleets (Fig. 198). A portion of Los Angeles harbor is set aside for this industry, and is known as "Fish Harbor." Here are located the docks, canneries, homes of fishermen, oil stations, and all other services for outfitting the fleet.

Sardines are fished largely off Monterey Bay in the cool waters of the California current where they feed on plankton. Monterey is called "the Sardine Capital of the World" because of its successful competition with European suppliers since World War II. Sardines are canned in Monterey, which becomes a very busy place when the laden fishing vessels come in. Considerable sardine canning is also done in Los Angeles.

Tuna, sardines, mackerel, and an increasing amount of other fish are taken in different periods of the year. Tuna are caught from June to September, sardines from November to March, and mackerel largely in winter. This seasonal distribution gives employment for fishermen throughout the year. The newness of the fishing industry, the planned harbor and facilities, the large boats, and year-round employment of fishermen have resulted in making Los Angeles the best organized fishing port in the world.

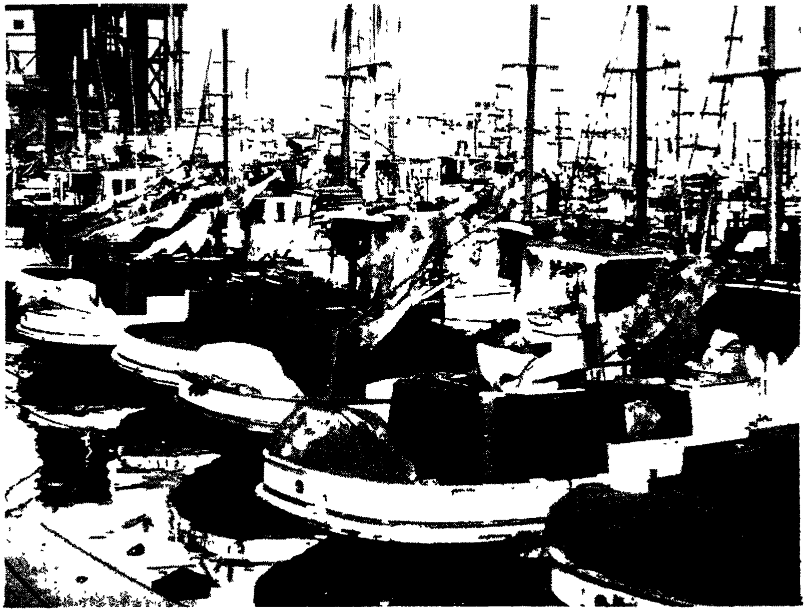


Fig. 198. Fishing fleet in Los Angeles harbor. Here the fleet is at rest between trips. The great variety of fish available in waters off southern California makes fishing an important industry in Los Angeles County. Many canneries are located in the harbor area. *Courtesy, Los Angeles Chamber of Commerce.*

San Francisco has its "Fisherman's Wharf" and is noted for crab fishing and abalone caught in the waters off Golden Gate, but it is not as important a fishing center as either Seattle or Los Angeles. Aside from the centers that have been named, there are numerous other fishing ports on the West Coast. The wide range for tuna fishing off the southern coast of California is an important factor in making California the leading state in the Union in value of fish and fish products.

THE RESORT AND TOURIST INDUSTRY

The improvement in means of transportation has brought to the West a resort and tourist business that affects people everywhere except in the most remote places. Its awe-inspiring mountains, canyons, caverns, big trees, petrified forests, geysers, lakes, deserts, subtropical beaches, and wide spaces are truly attractions that justify the advertising, "See America First." And though the West is not old, it offers many so-called "historic spots," recounting the spectacular early settlement and development days.

Early in the twentieth century the first resorts were sponsored by the railroads. Hotels and lodges were built in scenic places and much advertised. Resorters could come and stay for a period of time with all accommodations provided, or they could travel and see the West from the Pullman window. The United States Government took an interest in the preservation of scenic spots and created numerous National Parks, Monuments, and Forests, and to a considerable extent state and local governments did likewise. The automobile and modern highways have brought the West within reach of many who have small means, as well as those with wealth. Many miles of highways have been improved mainly to accommodate the tourist. Hotels, resorts, tourist cabins, and overnight lodgings are available wherever there are highways. Ski runs, dude ranches, fishing grounds, winter resorts, or summer resorts, any or all, may be had by selecting the place, and all the Western States advertise for tourists and receive them by the hundreds of thousands. Employment and income in the West resulting from catering to travelers, runs into millions of dollars annually, and in many instances is the sole support of entire towns and villages. El Paso, Santa Fe, and Tucson, just to name a few, are towns that make this a main business. Many others could be named. Railroads have fast trains to reach certain parts of the West, and airlines run to all large centers on the West Coast, thus providing swift transportation. Tourists truly bring a "big business" to the West.

THE MOTION PICTURE INDUSTRY

In 1900 there was not one movie theatre in the United States. In 1950 there were about 17,000 with a seating capacity of over 11,000,000. The making of motion pictures is a product of science and research, beginning with still pictures, then progressing to the film and motion pictures. The West was selected for picture making at first because it afforded the locale for popular "Wild West" stories. Since early picture making was mostly an outdoor business, it was necessary to have sunshine, cloudless skies, and mildness the year round. The first studios were located in Los Angeles in 1909, and others followed rapidly. The suburban section where most studios were segregated was Hollywood, which soon grew to be a distinct city. Hollywood still has most of the studios, but some are located within Los Angeles and the other suburbs. There is at present a growing tendency for studios to be located in the outlying areas about Hollywood.

In addition to mild climate and clear skies, the Los Angeles area has a great variety of outdoor scenery which can be used as a setting for almost any picture. Strange to say, however, the very factors that tended to locate this industry are no longer operative, for today most pictures are made in large enclosed studios with the aid of artificial lighting and painted scenery. Nevertheless the advantage of an early start seems to have fixed the Los Angeles area as the center of production. The newest threat to this business is television, which could make the numerous theatres throughout the country unnecessary because pictures could be seen at home, or it could result in change of location of picture making to a more central location to take advantage of transmission. No one knows what the outcome may be, but it has been demonstrated in the past that an early start that serves to entrench an industry in a certain location is a very strong factor in holding that industry to that place.

In 1950 the picture-making business was still dominately a United States industry, for 75 per cent of all moving pictures are made in this country, and 90 per cent of the United States product is from the Los Angeles area, mainly Hollywood. The payroll for the picture-making industry amounts to millions of dollars annually, and the number of actors, producers, writers, artists, craftsmen, cast, and common labor, with their families, make a sizable population. The motion-picture industry is an important factor contributing to the remarkable growth of population in the West.

THE OUTLOOK FOR INDUSTRIES IN THE WEST

The future for industries in the West seems to be rather bright, and particularly so in view of the remarkable increase in population. Increase in numbers of people means an increase in home market. Throughout the preceding discussion it has been pointed out repeatedly that, though the

West has great resources, it has a small local market, and the populous eastern market is far away, thus limiting the West, in a large measure, to the production and conditioning of raw materials to be manufactured elsewhere.

The West has made the most remarkable increase in population of any section of the country since 1930. In 1950 California and Arizona led all states in percentage of population gained over the preceding census. Both of these states showed more than 50 per cent increases in the decade. Nevada had a 44 per cent increase, and all other Western States except Idaho and Montana showed increases well above the national average. The "Westward Movement" has not ended. Population analysts are predicting further increases for 1960.

No doubt the reasons for great gains in population in the West are due to the abundance of resources previously discussed, to improvements in transportation, new techniques, and building of power projects, and to the stimulus of war and the armament program. Chemical and metallurgical industries are attracted to the great hydroelectric power sites, or within a 300-mile radius of them, for use of cheap power.

With the evident increase in importance of the Pacific and Far East in world affairs, the West Coast states will take on more of the nature of a front door than has been so in the past, and all of the West will be benefited therefrom.

QUESTIONS, EXERCISES, AND PROBLEMS

1. Will the West ever have a city as dominant among western cities as New York is among the cities of the East? Give reasons for your answers. Consider all factors, particularly those affecting the growth of manufactures.
2. Classify the larger urban groups of the West as to location and geographic conditions affecting their growth. Which are likely to be great industrial centers in the future?
3. Is it possible for California to develop an important iron and steel industry? Where is the best location for iron and steel plants in the West?
4. Make a study of the influence gold has had on the settlement and economic growth of the West. Has it affected the social conditions? There is enough material here for an excellent paper in historical geography.
5. Make a study of the geographic reasons for the location of the motion-picture industry in southern California. Do you think the West still has advantages over the East for carrying on this industry? How has the motion-picture industry influenced economic development of the West? How will television affect the location of the motion-picture industry?
6. Make a careful and detailed study of such mining centers as Leadville, Butte, and Virginia City. Do metallic mineral deposits lead to such permanence of settlement as coal beds? Give examples of your conclusions.

7. Analyze the airplane industry of the Los Angeles region from the standpoint of location, labor, raw resources, markets, and the possibilities of a shift of the industry to other places

8 Seek statistics from recent census reports and study population increases in Western States. Contrast with other sections of the country. What of the future?

9. The "smog," resulting from gases, dust, humidity, smoke, and other causes in the Los Angeles area has been of much concern and interest lately. Seek information on this topic and learn of its causes, its handicaps, possible abatement, and future effects on the area

CHAPTER 19

Alaska

Is Alaska suitable for a permanent home for white men in any considerable numbers? Do Alaskan resources warrant the conclusion that a population equal to that of Finland or of Sweden can be supported? Can Alaska ever become of importance as a home for man?

A Land of Retarded Development. Alaska was first visited by the Russians in 1741, and Russian traders and trappers soon entered the country to obtain fur. They established the first settlement in 1784 on Kodiak Island, and in 1804 founded Sitka, which became the seat of government the following year. During the 83 years that Russia occupied Alaska it obtained $45,000,000 worth of furs but did little to develop the colony. The 500 colonists were even provided with food from Siberia. Russian rule ended in 1867 when the United States purchased Alaska for $7,200,000. It was then popularly known as an arctic waste suitable only for primitive natives, trappers, and hunters. Fine furs were thought to be its only asset, and little attention was given to the territory for many years. It was in charge of the War Department with no government at all except near the army posts, and for 7 years more it was under the Treasury Department. Nearly 50 years elapsed before Alaska had any form of local government. During that time it was administered from Washington, 5000 miles distant. It was given a homestead law in 1903, the right to export timber in 1909, a Territorial Legislature in 1912, a coal-land leasing law in 1914, and an oil-land leasing law in 1920.

The negligent and dilatory attitude of Congress toward Alaska has been an important factor in retarding development. It is still a frontier land, a vast undeveloped territory of 586,400 square miles, a land containing resources of great potential wealth but few people (Fig. 199). The population has risen and fallen with the rise and fall of gold production. Hopes of a fortune quickly obtained brought a rush of prospectors, and failure to realize those hopes caused them to leave. The population is estimated to be approximately 100,000—about the same as that of Duluth, Minnesota—and most of the people live in the southern and southeastern districts. Slightly more than half the total population are whites. The other half are primarily Eskimo, Indian, and Aleut, as less than 1000 people belong to other ethnic groups. There are 25 incorporated towns with more than 1000 people, Anchorage being the largest with about 15,000. More than 99 per cent of Alaska is still owned by the Federal Government, and both Federal and territorial income is collected as taxes or licenses, chiefly from the fisheries and business enterprises. Some people hold that development of a frontier country like Alaska cannot progress far under present leasing laws; others believe that these laws are adequate for present needs and will prevent acquisition of Alaska s wealth of resources by a few individuals or corporations. Whatever may be the correct viewpoint, it is certain that progress of a substantial nature can come only with the establishment of permanent industries. It is also clear that man will not risk large invesments in a frontier country like Alaska unless large profits are reasonably certain.

Past and Future Production. White men tend to go where great potential wealth exists, whether or not the laws of a stable government exist. This has been more or less true in Alaska. Notwithstanding the mining and leasing laws that have been in force, the total production from mines, fisheries, forests, agricultural, and pastoral lands has been very large. Though accurate statistics are not available, estimates indicate that Alaskan products, for the period 1867–1950, were valued at approximately $2,500,000,000. The major portion by far of this huge sum was derived from gold, copper, fisheries, and furs.

It appears that only a small fraction of the mineral and other resources has been taken. Minerals of excellent quality, in great variety and in large amounts, remain. The coal deposits exceed 50,000,000,000 tons; usable water power is abundant in southern Alaska; and prospects for producing petroleum on a commercial scale are considered good. The fisheries may be expanded and continued indefinitely under proper conservation regulations. The splendid forests are awaiting more extensive utilization. The large acreage of agricultural and grazing lands is almost wholly unexploited, though a start has been made. Greater production of raw materials and finished products for export, development of adequate interior transportation facilities, extension of manufacturing industries based upon utilization of local raw materials and power, and establishment of permanent local markets for the products of agriculture and grazing are all in the future. With their growth will come greater commerce and population. Alaska is still a land for the pioneer.

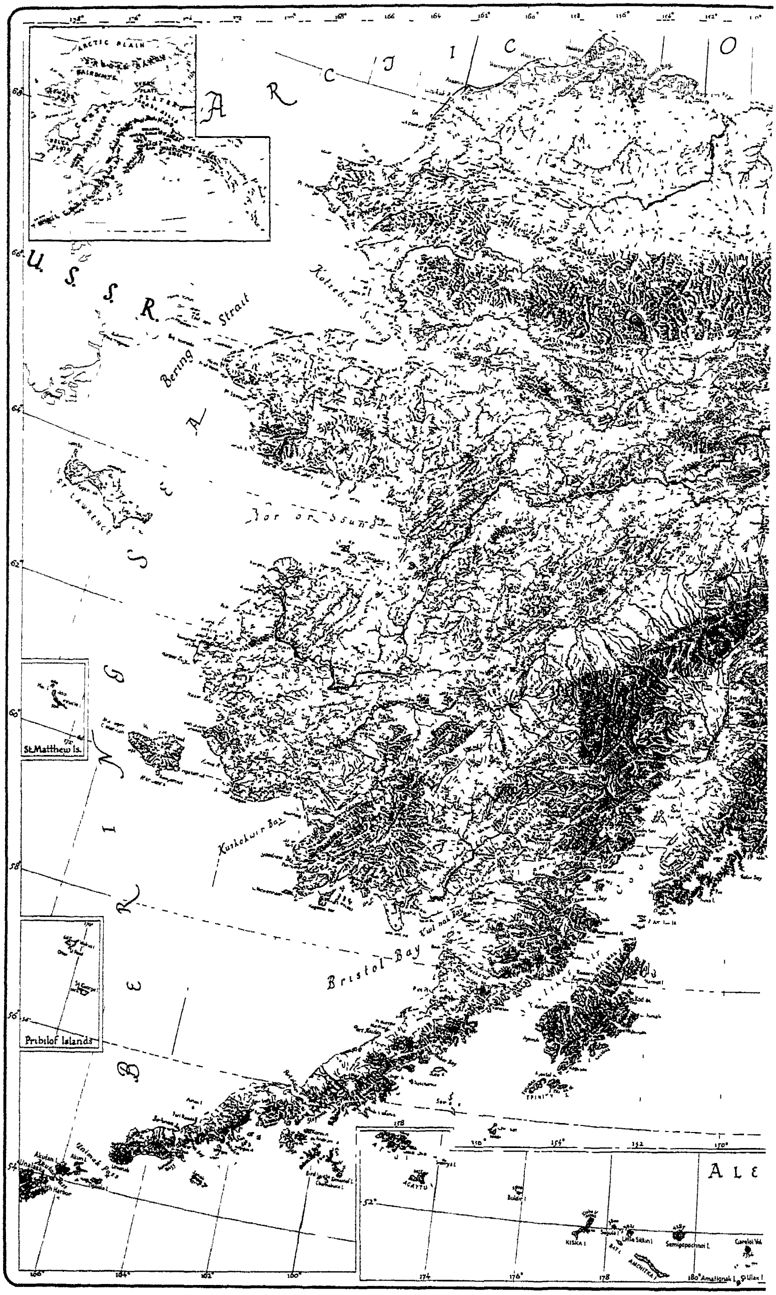
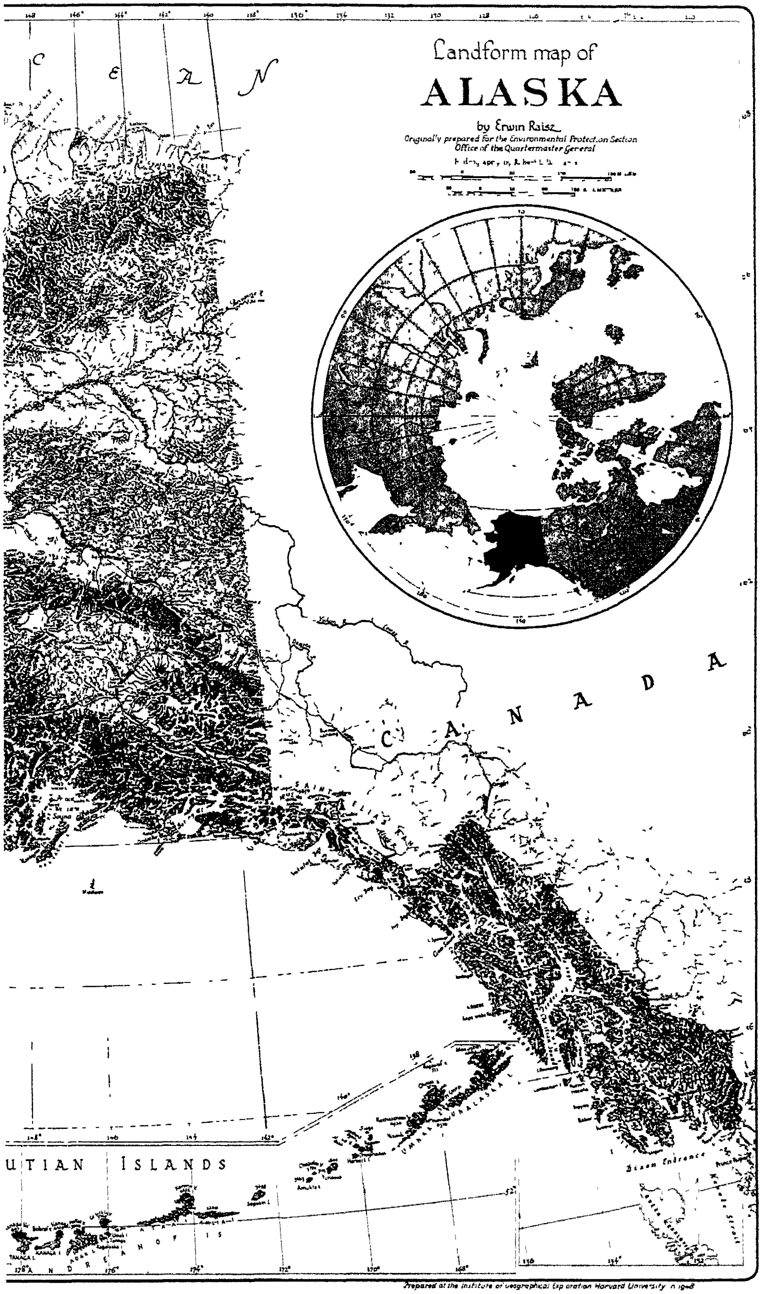


Fig. 199. Landform map of Alaska. *Courtesy,*


Landform map of
ALASKA
by Erwin Raisz
Originally prepared for the Environmental Protection Section
Office of the Quartermaster General
CEAN
CANADA
SAINT ELIAS RANGE
UTIAN ISLANDS
Dixon Entrance
Prepared at the Institute of Geographical Exploration Harvard University in 1948

Erwin Raisz. Compare with Fig. 200.

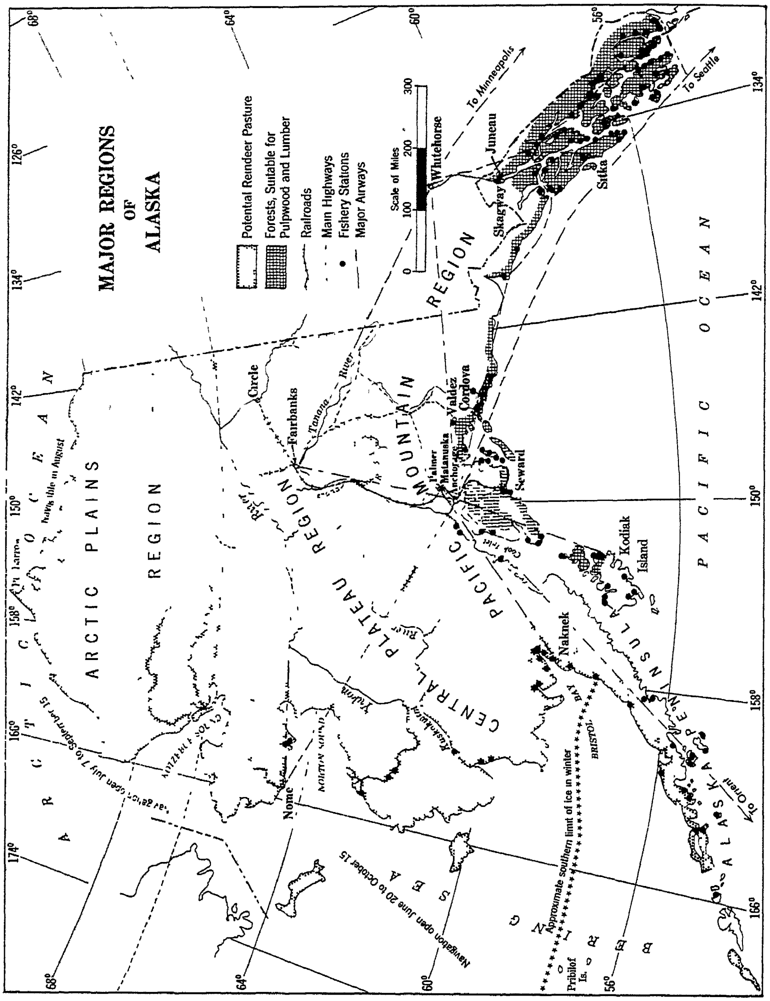


Fig. 200. Major regions of Alaska, its potential reindeer pastures, and its fisheries.

GEOGRAPHIC REGIONS

Alaska may be divided into three broad geographic provinces that present striking contrasts in surface, climate, vegetation, mineral resources, agricultural possibilities, and consequently in the opportunities for human use (Fig. 200). These provinces may be designated as (1) the Pacific Mountain region, (2) the Central Plateau region, and (3) the Arctic Plains region. The Territory has a very wide range of climate, with a corresponding range in native vegetation, varying from dense forests through the semiarid type to arctic tundra. These large variations are due to (1) great latitudinal extent, (2) the temperature of bordering waters: the warm Pacific, the cold Bering Sea and Arctic Ocean, (3) the direction of prevailing winds, and (4) the distribution and high altitude of the mountain ranges. The mean annual temperature varies from 40° in the south to 10° in the north, a greater range than prevails in continental United States (Fig. 202).

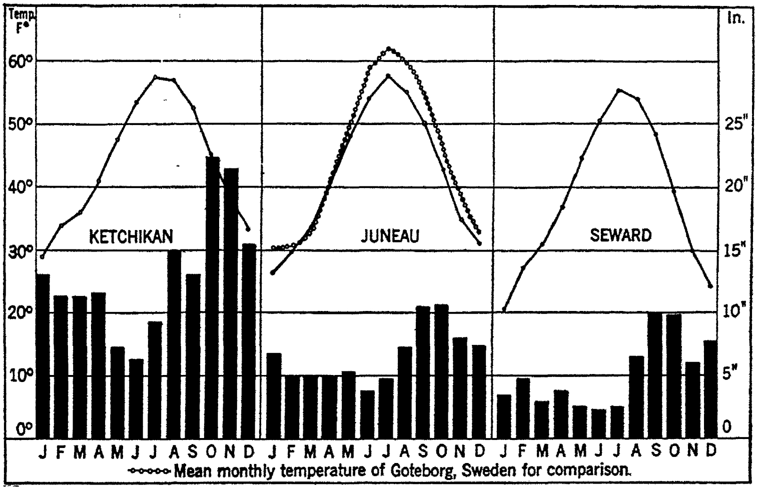


Fig. 201. Mean monthly precipitation and temperature at three stations along the Pacific Coast of Alaska.

The Pacific Mountain Region. The Pacific Mountain region is a continuation of the rugged mountainous district of the United States and British Columbia. It is a region of high relief and of great valleys, and extends some 1200 miles along the coast and about 200 miles inland. Numerous snowcapped peaks, such as Mount McKinley (20,300 feet) in the Alaska Range, rise to high altitudes, and scores of large glaciers descend to the coast from the extensive snow fields. It is a region of cold winters, mild summers, and very heavy precipitation, ranging from 50 to 120 inches annually. Snowfall on the higher slopes is heavy (Fig. 201). Contrary to popular belief, the mean winter temperatures of Sitka, Juneau, and of St. Louis, Missouri, are nearly the same, but the extreme minimum of St. Louis is much lower. Seventeen of the twenty-five Weather Bureau stations on the Pacific Coast of Alaska have never recorded temperatures lower than the St. Louis minimum of -22°. The summers, however, are damp and chilly. The lower mountain slopes are heavily forested with such valuable trees as hemlock, spruce, and cedar. Nearly all the best timber is included in the Federal reserves. The extensive forests comprise more than 26,700,000 acres and contain about 77,000,000,000 board feet of timber suitable for pulp and lumber. Much of the timber is now fully ripe and should be utilized at an early date. However, it probably cannot now compete in outside markets with the lumber of higher quality and greater variety available in Oregon, Washington, and British Columbia. The annual cut is now about 80,500,000 board feet, a large port of which is used for salmon cases. Fish, forests, and minerals are the

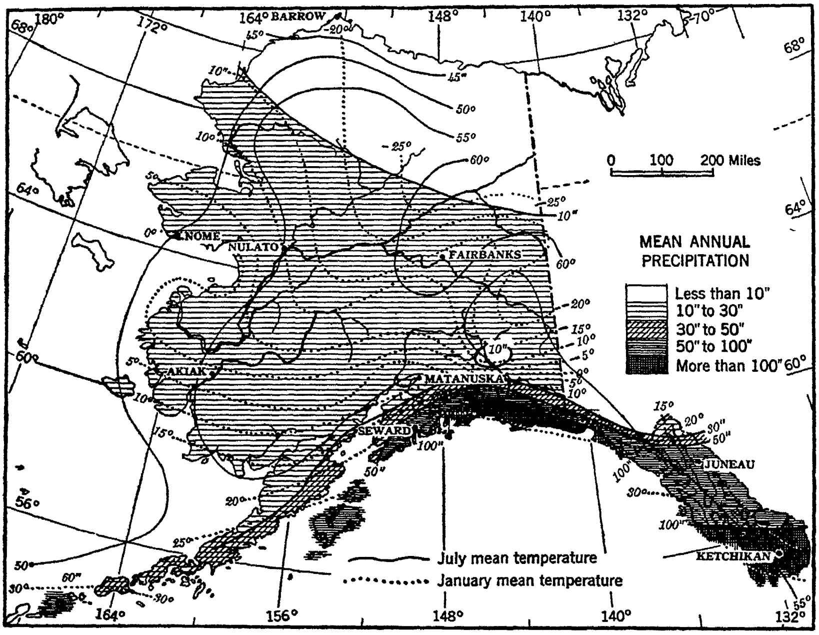


Fig. 202. Mean annual precipitation and mean temperatures for January and July. Compare with Figs. 203 and 204. *(After U. S. Weather Bureau maps.)*

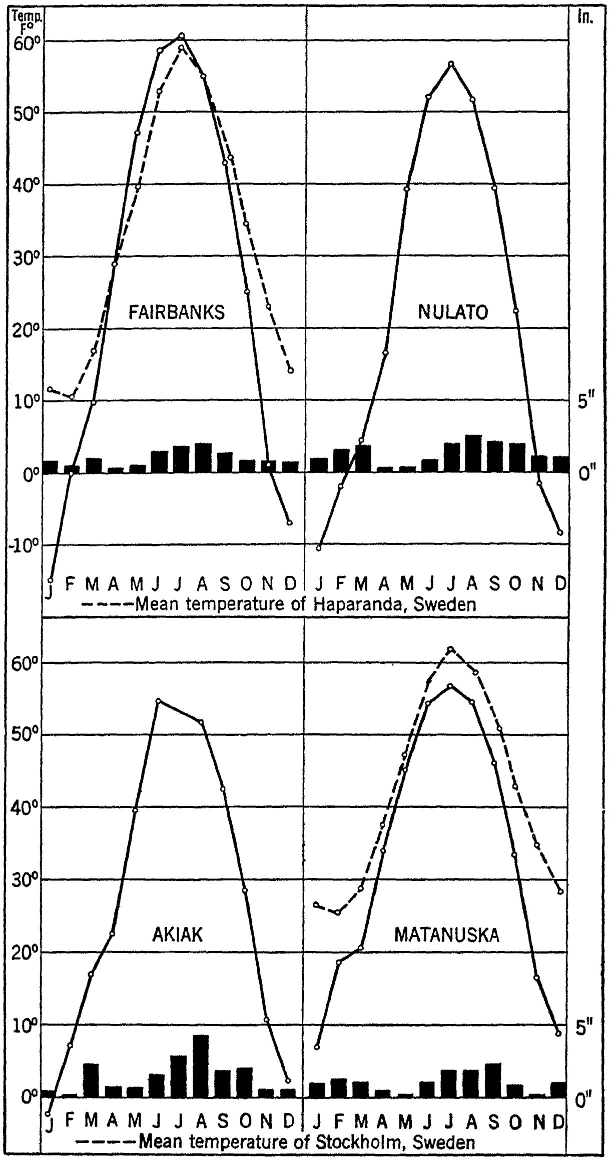


Fig. 203. Mean monthly precipitation and temperature at four stations in the Central Plateau region of Alaska.

principal economic assets of the region. Agriculture in favored localities, is fairly successful.

The Central Plateau. The Central Plateau region contains about 200,000 square miles, an area nearly as large as that of Nebraska and the two Dakotas combined. It is of relatively low relief, characterized by flat-topped highlands separated by broad stream valleys and lowlands, except along the Bering Sea section where broad lowlands broken by low, rounded hills dominate the landscape. Within it lie the basins of the Yukon and Kuskowim, the first being Alaska's great highway in summer, as it is navigable for 2200 miles. This is a country of short, mild summers with 18–20 hours of sunshine daily; the winters are long and cold (Fig. 203); and precipitation is scant (9–19 inches) with very little snowfall. The region contains much of the agricultural and grazing lands of Alaska and is rich in minerals; these are its two chief resources. A vast wealth of gold has already been obtained from alluvial gravels. About two-thirds of the area is forest of the woodland or small, open-growth type. However, not more than half the forested area carries timber suitable for commercial purposes and that cannot be utilized for more than local uses until transportation is provided. The principal species are white and black spruce, white birch, balsam poplar, black cottonwood, aspen, and tamarack. The forests of the Central Plateau are mere "scrubs" compared with those of the Pacific region, varying from almost nothing in the stunted black spruce areas to 20–30 cords an acre in the birch and aspen sections, and several thousand board feet an acre in the best white

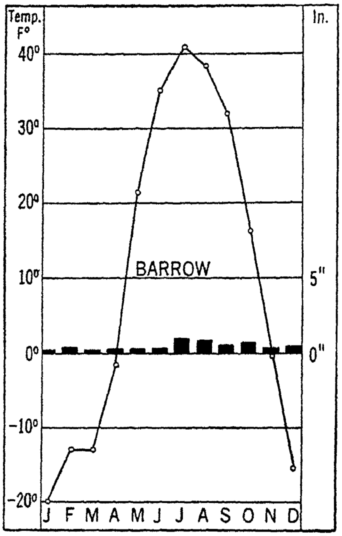


Fig. 204. Mean monthly precipitation and temperature on the Arctic Coast of Alaska.

spruce areas. Highly valuable pastures occur over much of the area and offer opportunity for the grazing of reindeer.

Arctic Plains Region. The northern region, separated from the Central Region by the Brooks Range, contains about a sixth of the Territory and may be truly called Arctic Alaska. It is a region of more or less rolling low relief, a slightly elevated plateau dissected by northward-flowing streams. Its climate is of the true arctic type, with only about 6-8 inches of precipitation, long, cold winters, and cool summers. Summer extremes of 66° and winter extremes of −54° have been recorded (Fig. 204). The long period of continuous sunshine, extending through days and weeks except when the sky may be obscured by clouds, produces a luxuriant growth of mosses, flowers, lichens, and grasses over much of the area even though the soil cover thaws to a depth of only a foot or two before winter sets in again. So far as is known the mineral resources of the region are small, though coal and petroleum are present. Production of reindeer or muskox upon its extensive pastures is probably the greatest opportunity that it offers to man.

MINERALS

Alaska is rich in minerals. There are reserves of gold, copper, mercury, coal, silver, platinum, tungsten, lead, marble, gypsum, and numerous other minerals, all of which are likely to be of significance in the future development of Alaska. The known occurances of petroleum are being explored, but there is no commercial production at present. The mineral resources are widely distributed throughout the Central and Pacific regions (Figs. 205, 206).

Gold first attracted large numbers of people to the Territory, and it has also held many of them there, since they have a permanent interest in Alaska in contrast with employees of the fish canneries. When a man can wash a fortune from the gravels in a short time with no more equipment than pick, shovel, and pan, he can pay costly transportation and endure hardship. Under these conditions alluvial gold mining developed rapidly for a time along the Yukon and other interior streams. As the bonanzas became exhausted and the yield per cubic yard of gravel became small, production declined. Large, power-driven equipment is necessary to work such deposits profitably. Its use requires transportation facilities, far more of which must be provided before the mineral reserves can be exploited fully. With the use of modern dredging and lode-mining equipment the Yukon River basin produces four-fifths of the entire Alaska output. The reserves of alluvial gold probably exceed in value all that has been produced to date. Fifty years ago three-fifths of the mineral

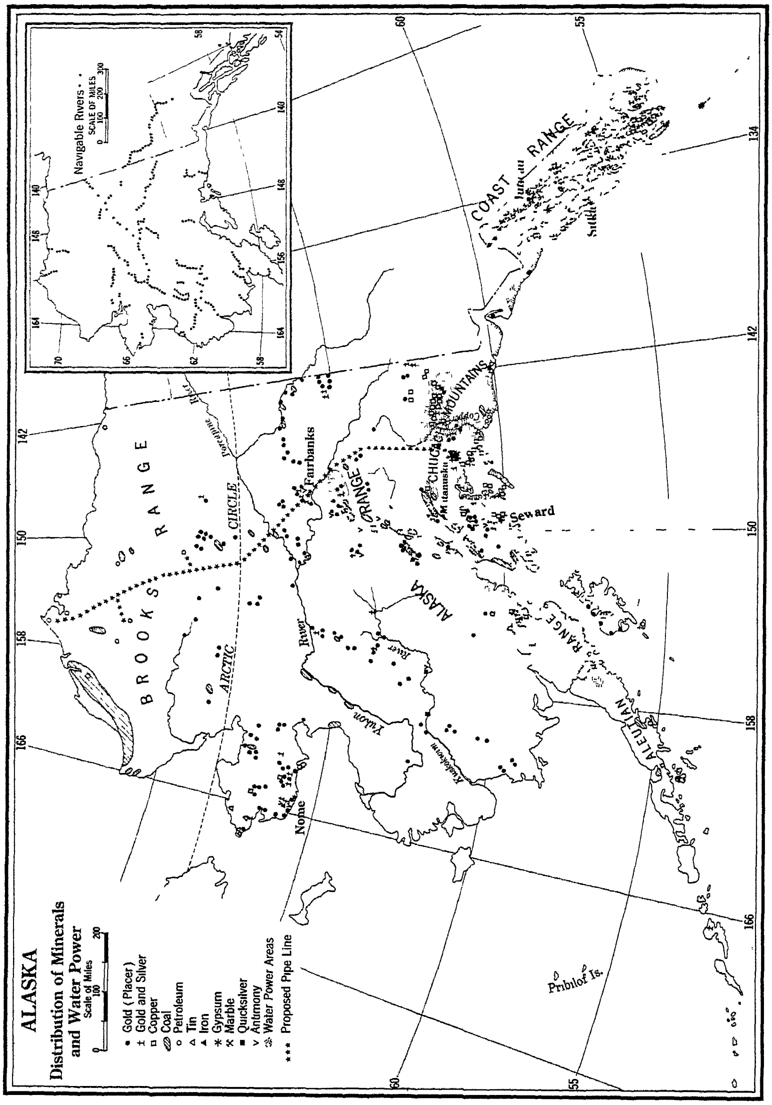


Fig. 205. Distribution of Alaska's minerals and navigable rivers.

output came from remote districts without good transportation, and now only one-twentieth. Hard-rock or lode mining can be conducted only where steamers, railroads, or good highways are available and freight rates relatively low. Fairbanks is the leading district. More remote deposits must await cheaper means of transportation than now exist. The total value of gold produced in Alaska is nearly ninety times larger than the price paid to Russia for the entire territory. Furthermore, the gold value alone is many times the net cost to the Federal Government for current expenses since the purchase in 1867.

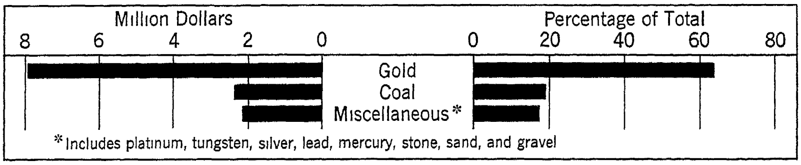


Fig 206 Principal minerals produced in Alaska. Three-year average.

Silver, copper, and lead are derived almost exclusively as by-products from ores mined mainly for some other metal, chiefly from gold ores. The once highly productive Kennicott copper mines ceased operation in 1938, with the exhaustion of the economically workable ores.

Coal deposits are also widely distributed, and the reserves are estimated to be about 50,000,000,000 tons, at least half of which can be made available easily. Most of the reserves are of subbituminous coal and lignite, but the fuel value of the Matanuska coals is as high as that of any

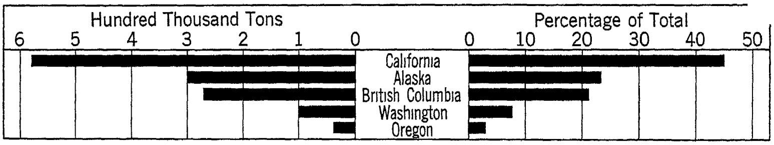


Fig. 207. Pacific Coast fisheries. Three-year average.

other coal on the Pacific Coast. Most of the present production of about 400,000 tons comes from the lower Matanuska Valley and Nenana fields, served by the Alaska Railroad. The Matanuska Valley is located about 45 miles northeast of Anchorage and the Nenana fields about 75 miles southwest of Fairbanks. The Matanuska coal is a good grade bituminous, and the Alaska Railroad provides the major market. However, the coal also has a good market throughout the southern coastal sections of Alaska. The Nenana (or Healy River field) coal is a high-grade lignite. The chief market is in the Fairbanks area where the coal supplies power and fuel for the city, and for mining, smelting, and various government installations. Other deposits along this railroad are now being developed. The present coal production is not sufficient to meet local needs, and some coal is imported annually. It is probable that the annual production will soon be sufficient to meet Alaskan needs. Coal mining by private companies was not feasible until 1914 when the government enacted a coal-land leasing law. The demand for coal in Alaska and on the Pacific Coast of the United States is sufficiently large to absorb all that can be mined for several years to come. An adequate market appears to be assured.

FISH AND FUR

Fisheries. The fisheries are the most important industry and were the first to be developed extensively. Fishing was carried on by the Russians long before the purchase of Alaska by the United States, and many American fishermen visited its shores regularly while Alaska was still a Russian colony. The first salmon canneries were not built until 1878. There are now more than 100 in Alaska, but the number operating varies yearly. Exclusive of aquatic furs, the annual value of the fishery products approximates $40,000,000, more than three-fifths of which is derived from salmon. The average value of the fisheries is more than three times that of all minerals mined. It has been estimated that the food supplied by salmon annually is equal to that furnished by 3,500,000 cattle, the maintenance of which would require millions of acres of pasture and cropland.

Fish are taken throughout Alaskan waters, but the investment in the fisheries of southeastern Alaska is nearly equal to that of the western and central districts combined. Salmon, halibut, herring, cod, and whale are the principal fish utilized. Salmon streams are found along more than 2500 miles of coast, and in the Yukon salmon spawn 2000 miles inland. The young salmon finds its way to the sea, where it remains until it is from 2 to 5 years old, when it returns to fresh water to spawn. At that time immense shoals of salmon gather along the Alaskan shores, and it is then that huge numbers are caught. Since the largest runs occur periodically with corresponding years of smaller runs, the fishing industry fluctuates in harmony with the habits of the salmon. Employment is commonly provided for thousands of people. Nearly all these employees are transients who migrate to Alaska to gather the harvest of fish, when the "runs" are in full swing, and leave again at the close of the season. Investigations show sufficient salmon to maintain the commercial fisheries indefinitely under adequate conservation laws.

Fur Industry. The search for fur first brought the Russians to Alaska, and fur remained the chief interest of the country for more than a century. Ruthless killing nearly exterminated the sea otter, and likewise the seal of the Pribilof Islands. Formerly, not less than 3,000,000 seal visited these islands annually, but the number had been reduced to only about 132,000 when the Federal Government took over the sealing industry in 1911 by authority of the North Atlantic Sealing Convention. By application of scientific methods of propagation and proper utilization of surplus animals the herd now exceeds 3,800,000, and, if the present methods of conservation are maintained, may increase its size. The annual kill of excess males is now about 70,000. Alaska has many fur-bearing animals and produces several million dollars' worth of fur annually. Most of this amount is obtained from the seal, fox, muskrat, and mink. With the advancement of settlement, a fur industry based upon the capture of wild animals naturally declines. However, fur farming may be extended almost indefinitely and thus develop a profitable and permanent industry.

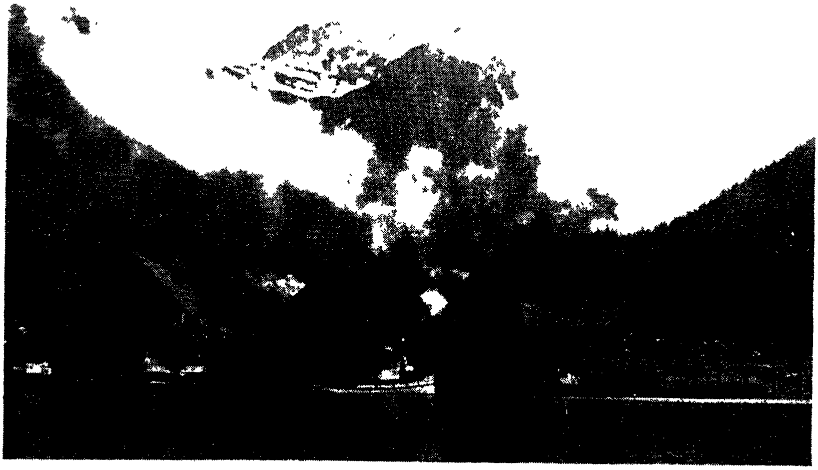


Fig. 208. Salmon cannery in Excursion Inlet, Alaska. Note the forest that extends to the shore line, and the fog that enshrouds the forest. *Courtesy, U. S. Fish and Wildlife Service.*

AGRICULTURE AND GRAZING

The feasibility of agriculture and grazing in Alaska has been demonstrated since crops and livestock have been produced by white men for more than a century. Though the agricultural resources are almost wholly undeveloped, crops of wheat, rye, oats, barley, hay, potatoes, and hardy vegetables are produced for local consumption. The most extensive development has taken place in the Matanuska and Fairbanks sections where the farm produce found a ready sale in the towns, mining camps, and military bases (Figs. 209, 210). Present crop production in Alaska is limited by transportation facilities and markets rather than by either climate or soil. Until time changes these conditions, large crops cannot be produced profitably, as Alaska's farmers cannot compete in exports with other countries. Present production, therefore, is merely indicative of what may be produced in the future. When the more desirable lands of the continent are taken up and the pressure of population is felt, as it has long since been felt in Europe and the Orient, Alaskan agricultural lands will be used.

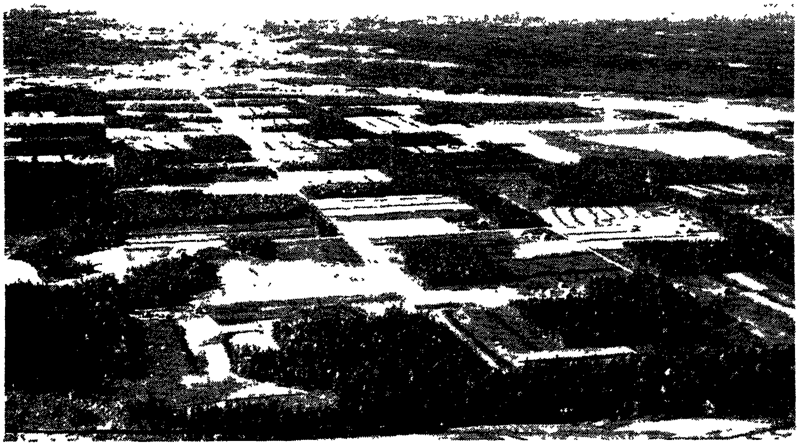


Fig. 209. Agricultural pattern in Matanuska Valley. *Courtesy, U. S Soil Conservation Service.*

Arable Land. Estimates of Alaska's tillable and grazing lands vary from a realistic 7,100,000 acres to an unrealistic 60,000,000. The latter estimate disregards costly drainage, poor soils, and unfavorable climate. In addition there may be 150,000 to 200,000 square miles of reindeer pasture that varies greatly in quality. Figure 211 shows the basic land-resource areas as established by W. A. Rockie, of the Soil Conservation Service, after many years of field work throughout Alaska. Table XIV differentiates between that which can be cleared and cultivated and land suitable for grazing. It is probable that the best area is the Cook Inlet

Lowlands (15), of which Matanuska Valley is a part. The Fairbanks area (9, 10, 11) will probably develop as a second major crop and livestock center. Other regions offering large acreage for tillage and/or grazing are the Yukon-Tanana Uplands, the Aleutian Range, and the Alaska Ice Cap, which is a large, rugged, mountainous land mass but with many narrow valleys, with climate and soil favorable for agriculture. It is sig-

Fig. 210. A farm home in a mountain setting southeast of Palmer. *Courtesy, U. S. Soil Conservation Service.*

nificant to note that the minimum estimate of farming and grazing land is about half that of similar lands in Sweden and exceeds that of Finland by about 1,000,000 acres; these two countries now have large agricultural populations. Alaska also has large areas of land not considered of agricultural value, though poorer lands in parts of Europe are now producing crops. Much of the tillable and grazing land is in the Central Plateau region, particularly areas 9, 10, and 11, which is climatically best suited to the growth of crops. Fully half the area has a growing season of 70-105 days and a maximum of 18-19 hours of daily sunshine during the summer period. The scant rainfall is a greater influencing factor than either temperature or growing season. The grazing season for cattle and sheep is only about 100 days, though there is some winter pasture in the drier parts. Eight to nine months of indoor feeding is a handicap to livestock production, hence it is carried on only incidental to mixed farming. The area of agricultural land in the Pacific Mountain region is also large, but is probably more valuable for forest growth. Notable exceptions are the Alaskan Peninsula, Kodiak, and adjacent islands that carry a luxuriant

TABLE XIV

Estimated Acreage of Area in Each Land-Capability Class
(When land can be used by simply clearing and/or cultivating)
(000 Omitted)

	Tillable	Grazing
1. Arctic Lowlands	0	0
2. Brooks Range	0	0
3. Arctic Circle Uplands	2	3
4. Allakaket Lowlands	6	4
5. Upper Yukon Basin	110	105
6. Middle Yukon Basin	3	3
7. Lower Yukon Basin	90	210
8. Ophir-Iditarod Uplands	9	18
9. Yukon-Tanana Uplands	265	2395
10. Tanana Valley	180	120
11. Kuskokwim Valley	270	180
12. Bristol Bay Lowlands	75	50
13. Aleutian Range	525	350
14. Alaska Ice Cap	640	160
15. Cook Inlet Lowlands	500	500
16. Copper River Basin	105	70
17. Southeast Alaska Fiords	90	60
Total for Alaska	2870	4228

Courtesy U. S. Soil Conservation Service.

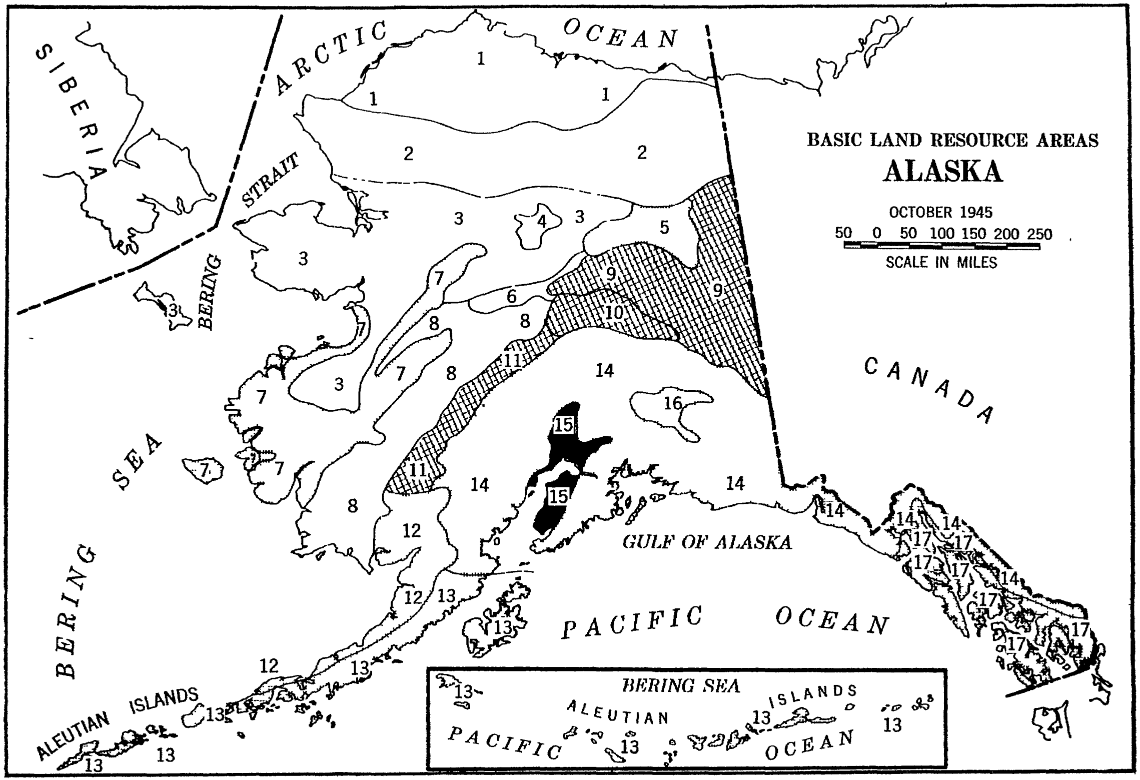


Fig. 211. Basic land-resource areas. *Courtesy, U. S. Soil Conservation Service.* The Cook Inlet Lowlands (15), which include Matanuska, probably rank first in agricultural potential, and the areas (9, 10, 11) centering on Fairbanks rank second. Each of the stippled areas has more than 100,000 potential acres. Other areas are insignificant for agricultural purposes. See Table XIV for names of numbered regions.

growth of grass. Cattle and sheep may be pastured for 6 to 8 months each year, and continuously in favored localities. These grazing lands are within 50 miles of ocean waters navigable throughout the year. The problem of winter feeding is yet to be solved, as the heavy summer rains are not favorable to the curing of hay. It appears probable that root and forage crops for ensilage may be the solution. Furthermore, the mosquito is a much less serious pest in this district than in the Central Plateau region. None of these potential agricultural areas have adequate transportation, with the possible exception of the small Matanuska and Fairbanks areas now utilized. However, 7,000,000 acres is an important agricultural potential and will provide homes for many people in some future period.

Soils. The soils of Alaska are of fair fertility. Only in the immediate vicinity of the streams can they be called rich and deep. Much of the agricultural area is wooded, and the ground is covered with moss. Both the timber and moss must be removed before crops can be raised. The heavy covering of moss is a poor conductor of heat, and beneath it the ground remains frozen. Much of the ground ice is a survival of a former colder climate and disappears or sinks to a level that permits crop growth when the moss is removed and the land cultivated. The ground ice that remains in cultivated lands during the dry summer is an advantage as it prevents drainage and supplies moisture to the crops. Where the soils are dominantly peat, from the accumulation of partially decayed vegetable matter, drainage is needed; in the driest parts of the interior irrigation may be necessary, though moisture supplied by the ground ice may prove sufficient.

So far as climate, soil, and topography are concerned, sufficient food can be produced to support a population of several million people. However, good accessible markets are essential to large crop production. The sparsity of markets for Alaskan agricultural products is in contrast with the abundance of such markets available to the farmer of Sweden and Finland. Further growth of agriculture, therefore, must await the establishment of other industries on a more extensive scale than exists at present, the more complete occupation of more favorably located lands elsewhere, and the development of adequate transportation facilities.

Reindeer Industry. The raising of reindeer for meat undoubtedly offers the greatest immediate opportunity for utilization of Alaska's pasture lands. Perhaps reindeer are to be the forerunner of agricultural settlement, as cattle were in the United States proper. However, vast areas suited only to the reindeer, or some similar animal, will remain after the agricultural land is taken up. The first small herd of 10 was introduced in 1891. From the natural increase and by subsequent importations, the number has grown to about 350,000. About two-thirds of these are owned by natives and are their chief source of food, clothing, and wealth. The practicability of the industry has been fully demonstrated. Estimates indicate that the natural grazing lands available are capable of maintaining 3–4,000,000 head. It is probable that the annual meat production from such a herd would exceed in value all the precious metals mined and would be second only to the fisheries as a permanent source of income. At least 1,000,000 reindeer could be maintained on lands that are now sufficiently accessible for profitable use.

TRANSPORTATION AND TRADE

Transportation. Modern man will not make his permanent home far from a modern system of transportation. Rivers serve fairly well in a new country, but if development is to take place more efficient means of moving men and goods are essential. Because of its great size, wide distribution of important resources, and long distance from American and foreign markets, adequate transportation is of vital significance to Alaska. Though the Yukon is navigable for river boats to Whitehorse in Canada, a distance of 2200 miles, it is open only 3 months. The Kuskokwim is navigable for 650 miles, and ocean vessels may reach its mouth during 4 months. These two rivers with their tributaries provide about 5000 miles of navigable waters which serve their basins in a very meager way. The snow cover and the ice on rivers, lakes, and bays favor overland travel in winter, but transportation by dog- or reindeer-drawn sledges is primitive at best and wholly inadequate for industrial progress. There are about 570 miles of main-line railroad completed, most of which is in the government railroad connecting Seward with Fairbanks along the Suisitna and Nenana valleys. A branch line extends into the agricultural and coal lands of the Matanuska Valley. There are also about 700 miles of gravel-surfaced highway, and airplane service has been established between the principal towns. The Alaska Highway now provides an overland route for automobiles, buses, and trucks (Fig. 212). A start, therefore, has been made to provide better transportation facilities, far more of which are needed.

Trade. The total trade of Alaska averages about $230,000,000 annually, with exports exceeding imports by a third. More than half the exports are fish products, and furs, gold, and platinum contribute a little more than 7 per cent. Imports are highly varied, with machinery, animal products, beverages, and petroleum products leading. Nearly all trade is with continental United States (Fig. 213).

Manufacturing. Processing of fish is the dominant manufacturing enterprise. The value of its products constitutes about 95 per cent of the value of all manufactures produced in Alaska. Other leading industries include smelters, lumber, printing and publishing, bakery, boat building, and machine shops.

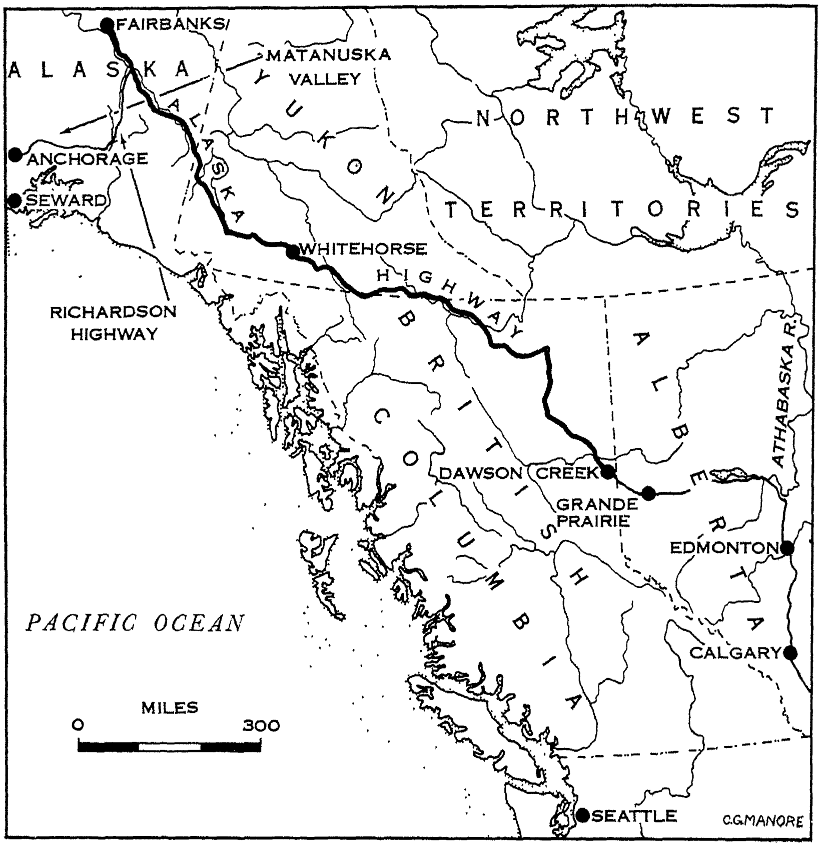


Fig. 212. The Alaska Highway.

ALASKA, SWEDEN, FINLAND

Alaska, Sweden, and Finland are in approximately the same latitudes, and present some interesting comparisons (Fig. 214). Alaska has a more favorable oceanic location, but the other two have access to far better markets. Sweden and Finland, respectively, have populations sixty-six and thirty-eight times larger than Alaska. Their people are progressive, capable, sturdy, energetic, and cultured. Both countries have evolved high types of civilization. This has been accomplished in environments possessing unfavorable climate and poorly endowed with other natural resources. Sweden has the larger potential water power, and Finland the larger area of good timber, but Alaska surpasses both countries in all other resources except iron. The extent and quality of the Alaskan iron deposits have not been determined. Alaska's potential food resources, measured in agricultural lands, grazing lands, and fisheries, are greater. The same is equally true of its metallic mineral reserves and of its power resources measured by fuels and water power combined. Fully three-fourths of Alaska has a climate superior to that of Finland and to much of Sweden. Sweden and Finland far excel Alaska in the present utilization of resources. This is strikingly true of the agricultural and grazing lands. Finland, with only a tenth of the arable land of Alaska, is an exporter of dairy products. A large proportion of its farms are relatively small, and the small farmer finds work during the winter months in forest industries. Much of Alaska's agricultural and grazing lands are in the interior, and the better forest areas are on the coast. Hence, if the Alaska farmer is to find work in the lumber camps during the long winters, he must travel considerable distances. Both Finland and Sweden are favorably located in relation to the markets of Europe, in contrast with the remoteness of Alaska from any outside markets. If Finland can support

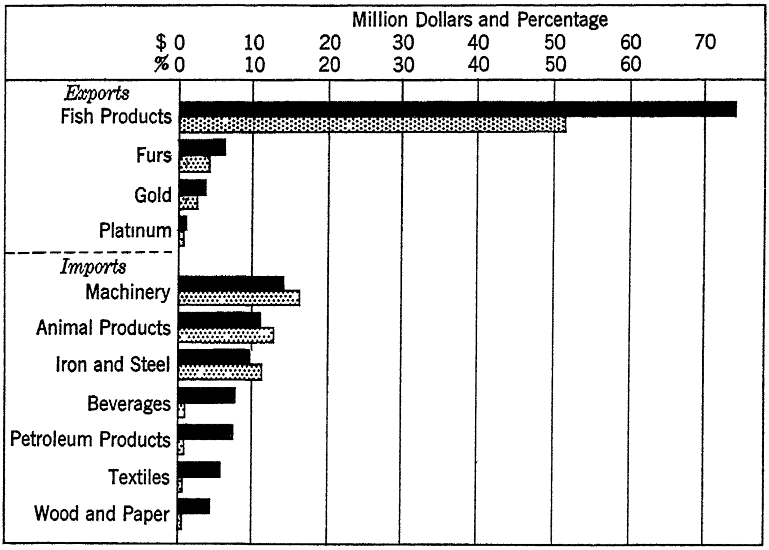


Fig. 213. Principal products in Alaskan trade. Three-year averages.

3,850,000, and Sweden 6,600,000, people, with natural resources inferior to those of Alaska, it seems reasonable to assume that Alaska may eventually maintain many more people than it now has. Nevertheless, the time when its population will compare favorably with either Sweden, Finland, or Norway is far in the future. People will not undertake the hardships of pioneer life in Alaska until better markets and transportation facilities are provided. This will come with the development of industries other than agriculture. Alaska may therefore be looked upon as a reserve for the future, to be used when the better lands and other choice assets of the United States have been more fully taken.

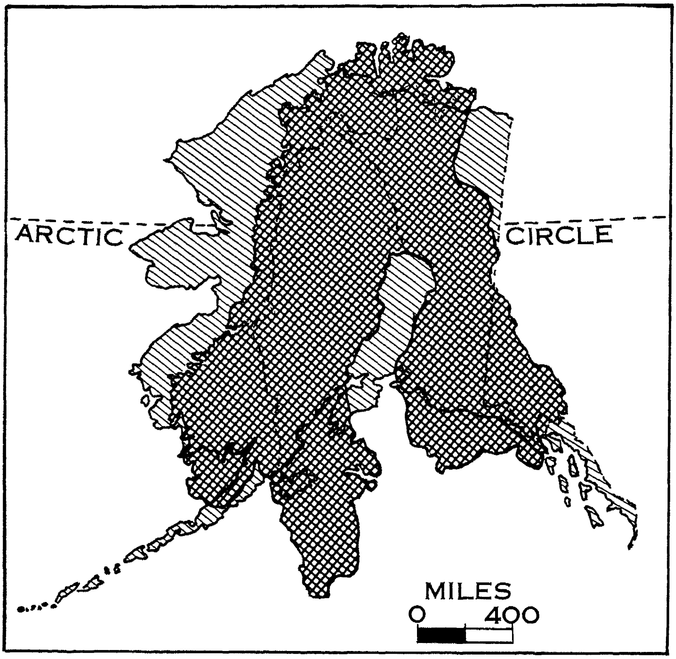


Fig. 214. Alaska is larger than Norway, Sweden, and Finland combined. They are located in the same latitude. Is Alaska potentially equal to those three countries as a home for man?

PROBLEMS

1. Is Alaska as suitable as a home for man as the Rocky Mountain and Plateau States?
2. Can Alaskan meat production equal that of the Rocky Mountain and Plateau States?
3. Will the agricultural and livestock industries become the leading ones in Alaska?

4 Can Alaska maintain a population equal to that of California?

5 What three factors have been most important in retarding the development of Alaska?

6 What resource is likely to wield the greatest influence in the future development of Alaska?

7. When will Alaska be as densely settled as Norway?

8 How does Alaska compare with Scotland as a home for man?

9. Which geographic region of Alaska is likely to have the largest population in the future?

PART III

Canada

CHAPTER 20

The Dominion of Canada

In this chapter we wish to survey the Dominion as a whole and observe the efforts of a people to build a nation from the materials of a northerly land.[1] *What is the general character of that land? What handicaps and what advantages does the land present to these people? What are the outstanding uses that have been made of the natural resources? Can the Canadian people develop a unified nation in opposition to the natural forces that tend to foster separation? What efforts are being made to bridge the barriers that separate the more fertile areas? Do the natural forces tend toward political unity with the United States rather than toward an east-west unity? Do these forces tend toward friendly, reciprocal relations with the United States?* These are a few of the many problems that arise as we study the Dominion.

THE POLITICAL UNIT

Canada occupies nearly all of that portion of North America lying north of the United States. Its southern extremity reaches 41° 41′ N. in southern Ontario, which corresponds with southern Italy. If we were to transfer the British Isles to central Canada, Lands End would rest at Winnipeg and the northern shores of Scotland would reach the mouth of the Churchill River.

Unlike most countries, Canada has three oceanic boundaries, but two are wholly or partly closed during a portion of the year. All its provinces except two border on salt walter. The Pacific and the Atlantic are its great natural outlets. On the east is has the estuary of the St. Lawrence; on the west the Prince Rupert and Vancouver entrances; and in Hudson Bay, Churchill and Moosonee. Considerable freight, especially grain, is now being handled at Churchill, but development is yet to come, if it ever does, at Moosonee. Canada is a northern or high-latitude country with all the climatic limitations that such a location implies. Only a small part of its area lies south of latitude 50°—probably less than 800,000 square miles. Canada is across the narrower part of the Atlantic from the great markets of Europe, especially from the British markets with which it maintains preferential trade relations. It has a most favorable location in relation to the great markets of the United States, in which it can dispose of much of its surplus raw and manufactured materials and from which it can purchase manufactured products and attract American investments. It is the shortest route from the Orient to Europe, by which route small packages of high value may be shipped.

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[1] Only a general view of Canada as a whole is presented here. This procedure is followed so the student may picture the country as a national unit rather than as isolated sections. Detail applicable to human-use regions is presented in the discussion of those regions even though apparent repetition occurs. See Chapters 21–24 for more detail.

Canada is a vast country with many variations in climate and other resources. The area is 3,843,000 square miles, and the water area is 228,307 square miles exclusive of Hudson, Ungava, and Fundy Bays, the Gulf of St. Lawrence, and other tidal waters (Table XV). In area, therefore, it is larger than the United States and Alaska or the European mainland. At present its developed portion is only an attenuated area along the southern border, an hourglass-shaped region which is restricted at Winnipeg, through which all east and west traffic must pass. Its eastern and western settled areas are separated by hundreds of miles of forested and little-used land—essentially a primitive wilderness with very limited po-

TABLE XV

LAND AND WATER AREA OF CANADA BY PROVINCES AND TERRITORIES

Provinces	Land, Square Miles	Fresh Water, Square Miles	Total Land and Water, Square Miles
Prince Edward Island	2,184	——	2,184
Nova Scotia	20,743	325	21,068
New Brunswick	27,473	512	27,985
Quebec	523,860	71,000	594,860
Ontario	363,282	49,300	412,582
Manitoba	219,723	26,789	246,512
Saskatchewan	237,975	13,725	251,700
Alberta	248,800	6,485	255,285
British Columbia	359,979	6,976	366,255
Yukon	205,346	1,730	207,076
Northwest Territories			
Franklin	541,753	7,500	554,253
Keewatin	218,460	9,700	228,160
Mackenzie	493,225	34,265	527,490
Newfoundland	——	——	42,734
Labrador	——	——	110,000
Total	3,462,103	228,307	3,843,144

tentialities. Economically and socially, it is essentially a northern extension of the United States. The interchange of commercial products is not unlike that between the South and West and the industrial northeastern section of the United States. Under modern conditions the settled or developed portions of a country do not extend far from transportation lines; hence vast areas of Canada are very sparsely settled, and much has not been explored except along the streams. The future development of the Dominion depends to a large extent upon the expansion of its transportation system, especially its railroads.

Canada was formerly chiefly a producer of raw materials—the products of the fertile lands, forests, mines, and fisheries. Agriculture held a dominant position in the production of wealth and in the employment of its people. Now secondary production, especially manufacturing, has taken the leading position. In spite of this relative decline agriculture ranks second. Yet the change is indicative of the tendency of a country, as it matures, to convert its raw materials into finished products within its own bounds.

THE PEOPLE OF CANADA

Distribution and Growth of Population. Examination of the population map of Canada (Fig. 215) reveals a land of large area and few people. Vast stretches of country are almost uninhabited. The concentration of its 13,200,000 people along the southern border emphasizes the attenuated character of the country. If the southern boundary were moved 150 miles north, Canada would lose nearly all its people. The reason for this is understood when one considers the climate, soil, and surface. Three-fifths of the total population is in Quebec and Ontario, nearly all being in the Great Lakes-St. Lawrence Lowlands. Here are located all, except two, of Canada's cities of more than 100,000 population; three-fifths of all cities of 30,000 or more; and the only cities—Montreal and Toronto—that exceed 500,000. This is also the dominant manufacturing, commercial, and financial section of Canada.

The urban population of Canada now exceeds the rural, as 54 per cent of the people live in cities, towns, and incorporated villages. During the last census decade, urban communities absorbed approximately three-fifths of the total population increase of Canada. These figures, however, are not comparable to those of the United States, where towns of less than 2500 are counted as rural. Quebec, Ontario, British Columbia, and Newfoundland are the only provinces in which the urban population exceeds the rural. In Newfoundland and Labrador nearly all the population is concentrated in urban communities along the coast.

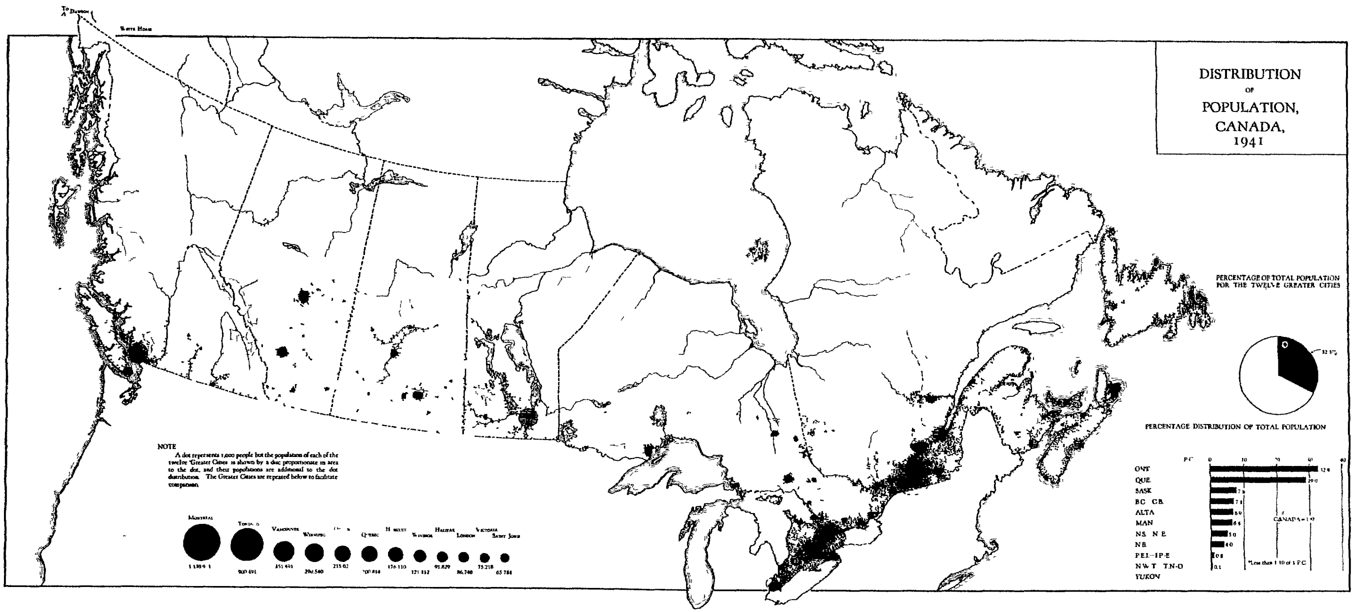
DISTRIBUTION
OF
POPULATION,
CANADA,
1941
To Dawson
White Horse
NOTE
A dot represents 1,000 people but the population of each of the twelve "Greater Cities" is shown by a disc proportionate in area to the dot, and their populations are additional to the dot distribution. The Greater Cities are repeated below to facilitate comparison.
Montreal
Toronto
Vancouver
Winnipeg
Quebec
Windsor
Halifax
London
Victoria
Saint John
1 139 9 1
900 491
351 491
290 540
215 02
176 110
121 112
91 829
86 740
75 218
65 784
PERCENTAGE OF TOTAL POPULATION FOR THE TWELVE GREATER CITIES
PERCENTAGE DISTRIBUTION OF TOTAL POPULATION
P.C.
0
10
40
ONT.
QUE.
SASK.
BC CB.
ALTA.
MAN.
NS N E
NB.
PEI—IP-E
NWT TN-O
YUKON
7 6
7 1
6 9
6 4
5 0
4 0
0 8
0.1
CANADA = 1 0
*Less than 1/10 of 1 P.C.

Fig. 215. Distribution of population, 1941. *Courtesy, Dominion Bureau of Statistics.* Note: One dot represents 1000 people, but the population of each of the 12 "Greater Cities" is shown by a disc proportionate in area to the dot, and their populations are additional to the dot distribution. The Greater Cities are repeated at the lower left to facilitate comparison.

The growth of Canada's population has been slow compared with that of the United States. Only during recent census periods has the increase reached or exceeded 1,000,000. The tendency for the population to shift from the east to the west, as in the development of the United States, appears to have ceased. Net gain in the Prairie Provinces has been small, whereas British Columbia has increased nearly a third. However, the absolute increase in the Great Lakes-St. Lawrence Lowland was very much greater, reflecting the extensive industrial advancement.

Composition. The population of Canada presents a striking homogeneity in contrast with the heterogeneity of ethnic stocks in the United States. British stock makes up half of the present population, about a fourth being English. About 30 per cent of the total is French. It will be seen, therefore, that four-fifths of the people belong to two human stocks. The remaining one-fifth is divided among thirty or more ethnic groups. More than three-fourths of the French are in Quebec, where they constitute four-fifths of the total population. The British are much more widely scattered throughout Canada, yet nearly half are in Ontario, where they comprise three-fourths of the total population.

PHYSIOGRAPHIC REGIONS AND CLIMATE

The surface features of Canada are primarily a northward extension of similar features in the United States, particularly the lofty mountain mass in the west, the mountainous section in the east, and the Central Plains. On the basis of surface and structure, Canadians have divided their country into six major physiographic regions (Fig. 216): the Maritime Region, the Canadian Shield, the St. Lawrence Region, the Interior Plains Region, the Pacific Coast Region, and the Arctic Archipelago and Hudson Bay Lowland. These regions should not be confused with present regions of human-use discussed in subsequent chapters. Human-use regions are not coexistent with physiographic or climatic regions.

Maritime Region. The Maritime Region has an area of approximately 80,000 square miles. It includes the Maritime Provinces, that part of Quebec on the southeast side of the St. Lawrence River, and Newfoundland. Its surface is mountainlike, but when compared with the Cordillera on the west it would be described as hilly. The rocks are made up chiefly of sedimentary and igneous strata which were laid down from pre-Cambrian times onward, then folded, faulted, and invaded by igneous rocks. Though settled at an early date, much of this area has not been thoroughly examined for mineral resources. Of the minerals, coal is of first importance, occurring in Nova Scotia and New Brunswick. It is estimated that Nova Scotia has a probable bituminous coal reserve of 1,967,-

000,000 tons, and New Brunswick 89,800,000. The iron reserves of Newfoundland are estimated to be in excess of 2,500,000,000 tons. Asbestos is the next mineral in importance and occurs in the vicinity of Thetford and Black Lake in southeastern Quebec, where, from a few square miles, is obtained most of the world's supply.

The region is well drained by numerous small streams, the rapids and waterfalls of which offer power possibilities. Owing to the character of its surface, its soil areas suitable for agricultural purposes are limited, although many sections are today producing crops and still other areas are capable of agricultural utilization. The climate has many of the characteristics of the continental interior since the air mass moves eastward as a part of the prevailing westerly winds. Springs are later near the sea, and summers are a little cooler. Summer temperatures of 85° and even 95°, and subzero winter temperatures are not uncommon. October is a month of severe frosts. In Nova Scotia the winters are slightly warmer than in southern Ontario, but in New Brunswick they are colder and are

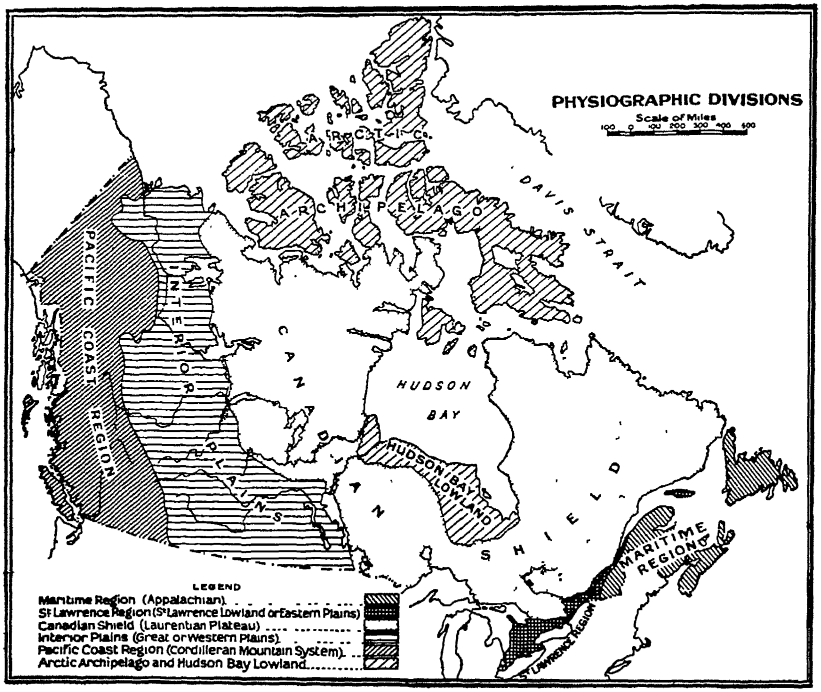
PHYSIOGRAPHIC DIVISIONS
Scale of Miles
100 0 100 200 300 400 500
ARCTIC ARCHIPELAGO
DAVIS STRAIT
PACIFIC COAST REGION
INTERIOR PLAINS
CANADIAN SHIELD
HUDSON BAY
HUDSON BAY LOWLAND
MARITIME REGION
ST LAWRENCE REGION
LEGEND
Maritime Region (Appalachian) ▨
St Lawrence Region (St Lawrence Lowland or Eastern Plains) ▦
Canadian Shield (Laurentian Plateau) □
Interior Plains (Great or Western Plains) ▤
Pacific Coast Region (Cordilleran Mountain System) ▨
Arctic Archipelago and Hudson Bay Lowland ▨

Fig. 216. The major physiographic regions of Canada. *Courtesy, Dominion Bureau of Statistics.*

comparable to those of western Quebec. Precipitation is abundant, being slightly greater in the fall and winter half of the year, and exceeds 50 inches on the south shore of Nova Scotia, though 40–45 inches is more general. The snowfall in northern New Brunswick is very heavy, exceeding 100 inches.

Canadian Shield. The Canadian Shield, or Laurentian Plateau, occupies approximately 1,800,000 square miles about Hudson Bay. It is roughly triangular in outline with the apex south of Lake Superior in the United States, and the base on the Arctic Ocean and Davis Strait. The western boundary extends southward from the Arctic Ocean along the line of lakes from Great Bear, Great Slave, Athabaska, and Winnipeg, to Lake of the Woods, where it crosses into United States territory. The southern boundary extends from the southeastern part of Georgian Bay to the vicinity of Quebec, and includes the Labrador Peninsula.

This vast region is known only partially even along its southern boundary. Much of its interior has not been explored except along the streams. It is made up largely of granite, gneiss, limestones, and slates. Geologically, its rocks are among the oldest forming the land surface of North America. Portions of its area are barren rock surfaces, but in most places there is sufficient soil in the various depressions or crevices to sustain forest cover. South of James Bay is a large area known as the Clay Belt, covering part of the bed of an old glacial lake, which is thought to have agricultural possibilities. The Shield as a whole was largely stripped of its soil by the glacier and other erosive agents. Here and there are local areas suitable for farm land. The region, in general, is of moderate relief broken by river valleys, by lake basins, or by occasional rocky hills that rise above the general level. Nowhere, except in northern Labrador, does it exceed 2000 feet in elevation, and in most places it is less than 1000 feet above sea level. In general it resembles a plainlike country depressed toward the north and in the center, and elevated slightly along the southern and eastern borders. Portions are true plains, and other parts are somewhat rugged but not comparable to a mountainous country. Most of its streams flow into Hudson Bay; others flow to the Great Lakes, Arctic, and Atlantic outlets. Thousands of lakes dot its surface. From the standpoint of human occupancy the Shield constitutes a wedgelike barrier between the Great Lakes-St. Lawrence Lowlands and the Interior Plains and is bridged by non-productive railroads, and partly by transportation on the Great Lakes.

Over such a large extent of territory, variation in climate, minerals, plant life, and other resources is to be expected. The southern portion is known to be rich in minerals, and it is highly probable that mineral deposits of economic value may be discovered throughout the area.

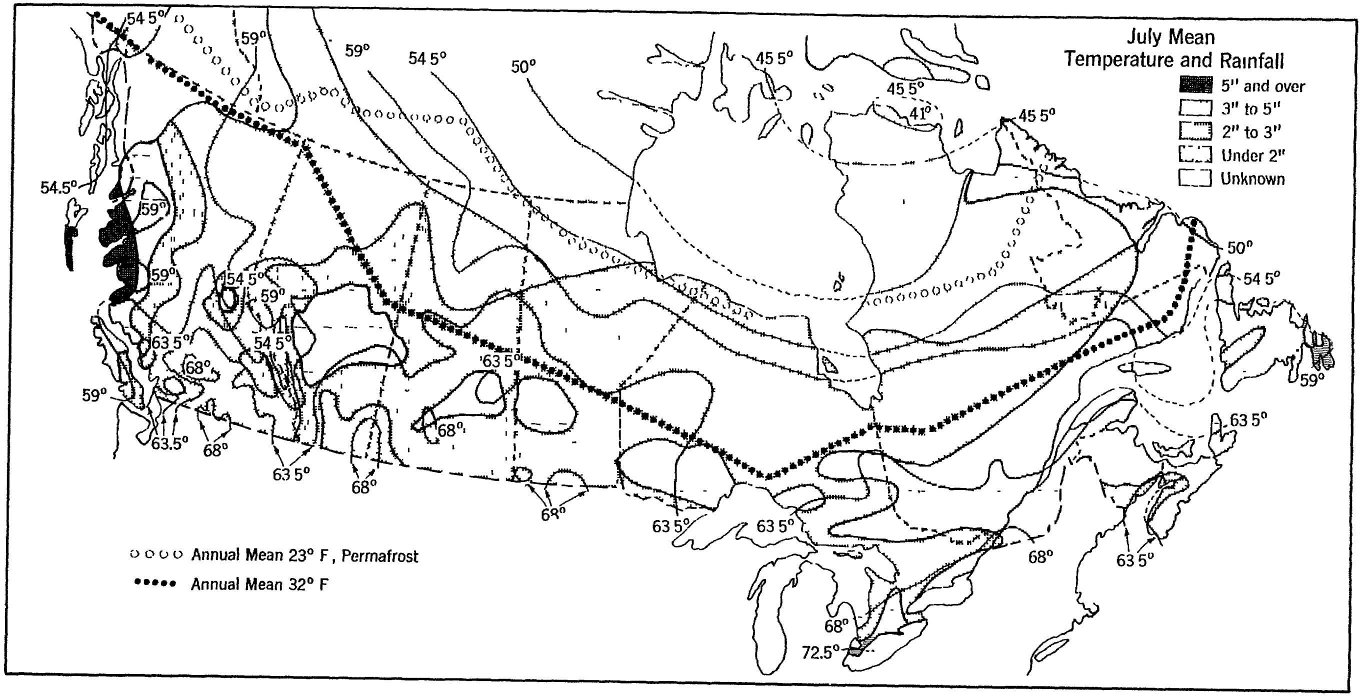

Fig. 217. Distribution of July precipitation and temperature *After Canadian Meteorological Service*. Compare with Figs 218 and 219.

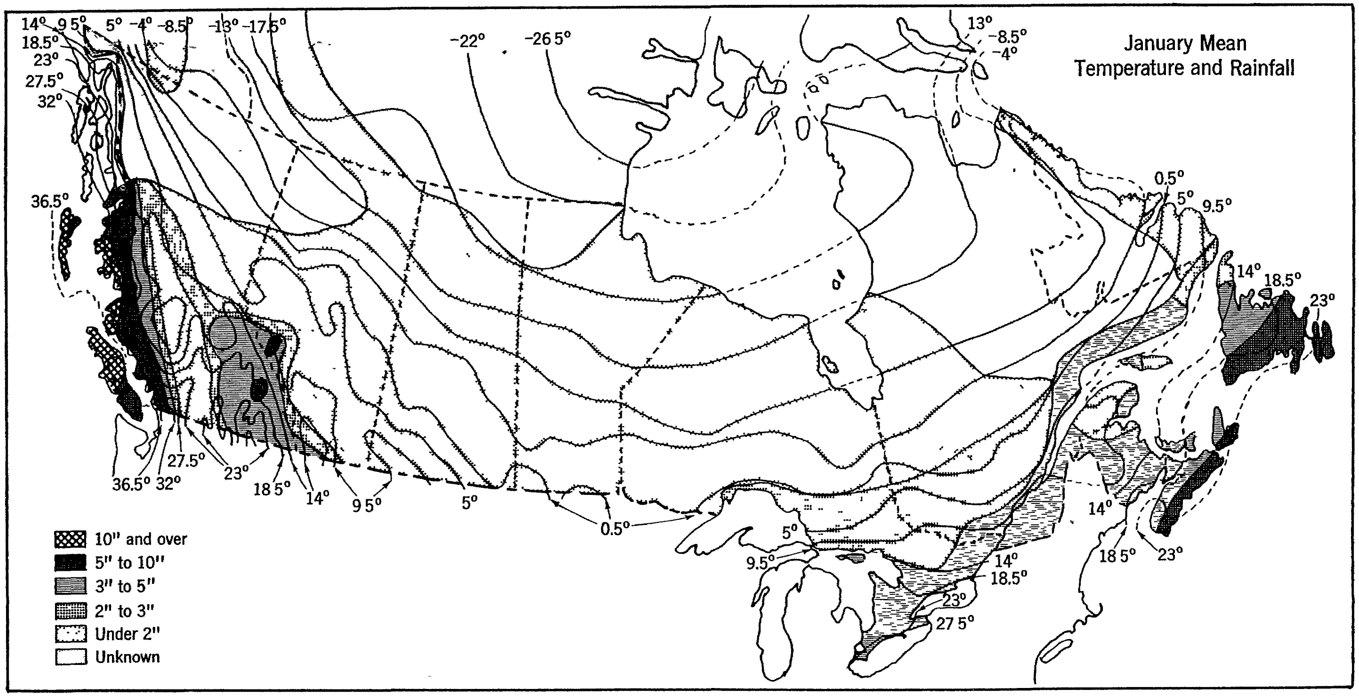

Fig. 218. Distribution of January precipitation and temperature. Compare with Figs. 217 and 219. *After Canadian Meteorological Service*

Nickel, copper, uranium, silver, gold, iron, mica, and graphite are among the important minerals now utilized. The nickel and silver fields of Cobalt and Sudbury produce most in value of all minerals obtained from the Canadian Shield. Much of the area is forested, and the forests of the southern part are of high commercial value.

Few meteorological stations exist in most of the area lying north of the St. Lawrence Region and the agricultural area of the Prairie Plains. Over the vast area of northern Canada, the climate is the subarctic type (Figs. 9, 217, 218) except for local variations; e.g., in the Mackenzie River Valley the summers are warm, and wheat has been matured north of the Arctic Circle. It is probable that similar mild conditions prevail over the region lying between the Mackenzie and the Rocky Mountains. On the whole, the winters are cold, and it is May before there is much growth. Frosts begin in September, and the winter begins in October. Summer rain is scant, and snowfall is light over the entire area. The climate of the north and east shores of Lakes Superior and Huron and of Hudson Bay is modified by these water bodies. However, the region is swept in winter by cold waves of great severity which pass unchecked over the region from the far northwest. The winters are very cold with heavy snowfall; the summers are generally warm, temperatures of 90° being recorded during the heat spells. Over much of the region, however, the margin of temperature safety is small, and frosts may occur during the summer months.

St. Lawrence Region. The St. Lawrence Region or Eastern Plains lies between the Maritime Region on the east and the Canadian Shield. It is the smallest of the physiographic regions, having an area of about 35,000 square miles. This region is a series of plains areas in Quebec and Ontario, extending west from the city of Quebec along the St. Lawrence Valley, and including the triangular portion of Ontario lying between Georgian Bay and Lakes Erie and Ontario. It may be subdivided into three sections: (1) the Ontario peninsula with a steep escarpment of limestone on its eastern border, (2) the Eastern Ontario basin, separated from the (3) St. Lawrence ~~River~~ Plain by a narrow southward projection of crystalline rocks. It has a great variety of fertile soil, which offers excellent agricultural opportunities, and is the region in which most of the people of Canada live. So far as is known, it has no metals or coal, but it has gypsum, petroleum, natural gas, salt, and clay suitable for the manufacture of structural materials.

In the peninsular portion of Ontario, April is a true spring month. Frosts are rare in May, and the trees are usually in full leaf by the end of that month. The mean temperatures are slightly above 70° in July, and only slightly lower in June and August (Figs. 217, 218). The tempering effects of the Great Lakes are evident in this section. Abundant sunshine and rainfall coming in showers prevail during the summer, and the winter monthly precipitation is about the same as that of the summer months. The autumn may begin in the latter part of September, but it is generally October before severe frosts prevail. Northward into the Ottawa Valley spring comes later than in the south, and autumn comes earlier. However, the summer temperatures are much lower. Here the ground is covered with snow earlier than in the south, which is an important factor in lumbering operations.

At Montreal, farther east along the St. Lawrence in southern Quebec, March is a winter month, although April and May are as warm as in Toronto, and in midwinter Montreal is slightly warmer. The autumn is similar to that of southwestern Ontario, and is followed by a rapid fall of temperature in winter and a normal temperature 10° lower than Toronto. There is usually 1 to 3 inches of snow cover during a period of 4 months. Farther eastward in the St. Lawrence Valley, the summers are cooler, and the winters colder, with late springs. May is the spring month, and mid-September the beginning of fall. Throughout this area the precipitation is nearly uniform during the year.

Interior Plains Region. The Interior Plains extend from the Canadian Shield westward to the mountains and northward from the United States boundary to the Arctic, including an area of approximately 500,000 square miles. They embrace parts of Manitoba, Saskatchewan, British Columbia, the Northwest Territories, and nearly all of Alberta. The region as a whole has a nearly continuous soil cover of glacial, fluviatile, and lacustrine deposits which vary in thickness from a few to several hundred feet. Only on steep slopes or in the large stream beds is the underlying bedrock exposed. The country is relatively flat, increasing in altitude westward by a series of escarpments which divide the plains into three prairie levels. The first prairie level has an elevation of about 800 feet, and includes the almost flat Red River Valley, once the bed of Lake Agassiz. Its western border is a series of hills rising from 500 to 1000 feet and known as the Manitoba Escarpment. These hills extend northwestward about 300 miles from the middle of the southern boundary of Manitoba and parallel with Lakes Manitoba and Winnipegosis. The second prairie level has an average elevation of 1600 feet and a gently undulating surface, and extends westward some 250 miles to the Coteau or second escarpment. This escarpment, or series of hills, rises 200–500 feet, is nearly parallel with the first, and extends diagonally across Saskatchewan from near its southeast corner into Alberta. The third prairie level, with an elevation of 2500 feet in the east, rises to more than 4000 feet along its western border at the base of the Rockies. Its surface,

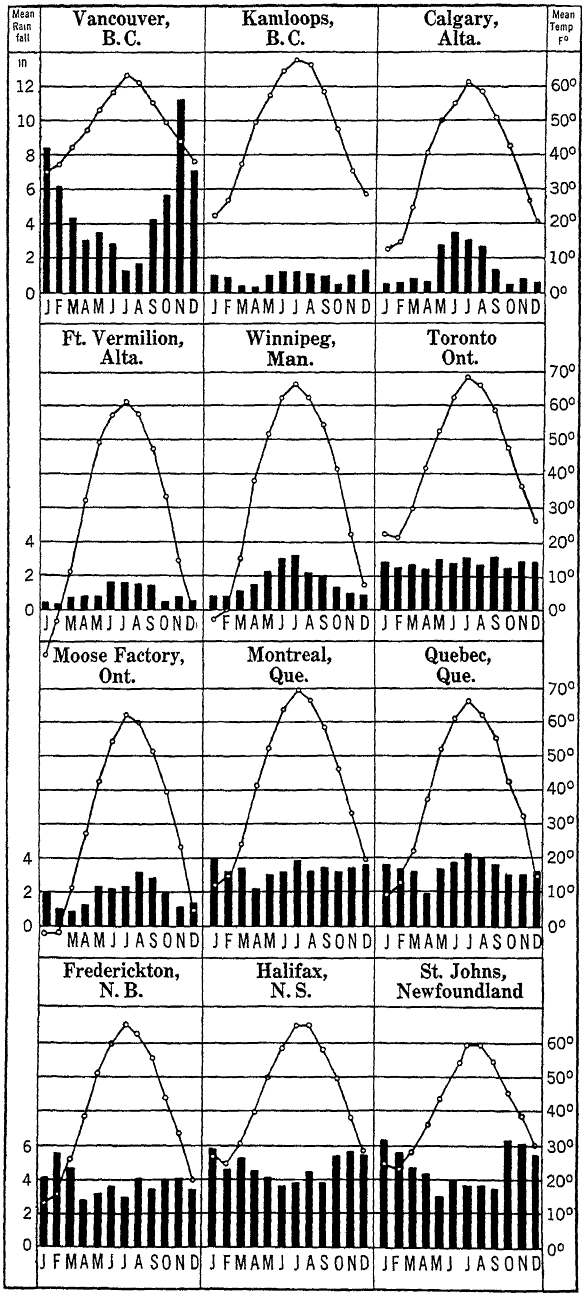

Fig. 219. Mean monthly precipitation and temperature at 12 stations. Describe the precipitation and temperature characteristics in each section of the Dominion. Compare with Figs. 217 and 218.

as a whole, is more irregular than that of the second level, as it is broken by deep valleys and tablelands like Cypress Hills and Wood Mountain, rising 1000–2000 feet above the surrounding level plain. The valleys, however, are scarcely discernible as one looks across the vast expanse of plains, as they are entrenched in a very flat country.

Like the St. Lawrence Lowland, or Eastern Plains, this region lacks metals, but has vast deposits of coal, chiefly lignite. The probable bituminous coal reserves of Alberta are estimated to be 35 billion tons, and the lignite reserves of Manitoba and Saskatchewan 13 billion. The petroleum reserves are not yet known, but exploration to date indicates reserves to be measured in terms of 2 to 5 billion barrels. There are also enormous reserves of natural gas and oil-bearing bituminous sands. The Interior Plains region also has gypsum and clay suitable for the manufacture of brick, tile, cement, etc. Most of this region is drained either to the Arctic Ocean or to Hudson Bay. Many of the streams are navigable in their plains portions, and others are utilized for irrigation purposes, particularly in southern Alberta.

The climatic variations over the Prairie Plains are considerable, and correspond very roughly to the first, second, and third prairie levels (Fig. 219). Manitoba, which corresponds roughly to the first prairie level, lies almost in the center of the continent and hence has the characteristics of the continental type of climate (Fig. 9). The mean annual range of temperature at Winnipeg is 71°, compared with 21° at Victoria, British Columbia. There is also a wide variation from the normal temperatures of winter. The January means for different years have ranged from 8° below normal to 13° above, and the February means from 25° above to 13° below. Frosts and light snows may occur in May, but are not usually severe. April is a spring month, with temperature rising rapidly during the summer. Winnipeg has an average daily maximum of 75° in June and 78° in July. Severe heat spells characterize the summers, when temperatures rise from 90° to 103°. The mean annual precipitation is 19 inches, being heaviest in the east and decreasing westward. Fifty per cent of it comes between May and August, largely from local convection storms. Snowfall in the east is about 52 inches, decreasing to 44 inches in the west. The ground is usually well covered with snow from December to March.

Saskatchewan, which corresponds roughly with the second prairie level, is similar climatically to Manitoba except that the spring is earlier in the southwest than in the north and east, and the midwinter Chinook extends at times eastward to Regina. The spring temperature is also a little higher, up to May, but the summer temperature is a little lower. Temperature extremes are greater than in Manitoba, being −56° and

107° at Regina. The daily range of summer temperatures is large, as in all the other Prairie Provinces. Frosts may occur during early June and the latter half of August. The average annual rainfall is 14–18 inches, 60 per cent of which comes during the growing season from May to August. There are 30–36 inches of snow in the west and south, and 40–50 inches in the east and north.

In southern Alberta, which corresponds roughly with the third prairie level, the winter climate is highly variable. The normal winter is cold. The extreme cold prevails from November to March in some years; in other years the winter is warm and sunshiny, on account of the constancy of the Chinook. This variation is shown strikingly by a series of temperature changes at Calgary: the mean in November for one year was 39°, and for another year it was 2°; in January the mean one year was –6° and the following year it was 26°. April is a true spring month, and by that time seeding is well along or may be completed. The temperature increases rapidly during May and June, reaching the maximum in July and August, which are hot months. The heaviest rainfall occurs from the middle of May to the end of July, and is about the same as that of southern Ontario and Quebec during the same period. The margin of safety, however, is small, hence a slight decrease below normal may seriously decrease crop yield.

The climate of this region has two striking features: (1) The summer isotherms run nearly north and south with a mean temperature nearly as high in the extreme north as in the south, and the long summer days of the north result in a very rapid growth of plant life. (2) The Chinook winds, which usually occur with strong west and southwest winds, are most frequent in the south, but occur frequently in the Peace River country in the north. The arrival of this wind may bring a temperature change from –20° to 40° in a few hours. The Chinook tends to shorten the winter season and reduce the severity of winter temperatures. Under its influence the grasslands are usually free from snow during the winter months, making grazing possible on the open range.

Pacific Coast Region. The Pacific Coast or Cordilleran Region extends from the Interior Plains to the Pacific Ocean, and includes nearly all of British Columbia and Yukon Territory and part of Alberta and the Northwest Territories. It has an average width of about 400 miles and extends nearly 1500 miles north and south, containing approximately 650,000 square miles. It is a region of lofty, rugged mountain systems with limited agricultural lands in the valleys. On the east are the Rocky Mountains, and on the west the Coast Range with a small central plateau which is broken by numerous smaller ranges. Just west of the Rockies is a valley known as the Rocky Mountain Trench, extending in a northwest-southeast direction for about 700 miles and containing parts of the courses of the Columbia, Frazier, and Kootenay Rivers, and two tributaries of the Liard and two of the Peace Rivers. West of the Coast Range is a paritally submerged mountain mass, appearing in Vancouver and Queen Charlotte Islands, which is probably a continuation of the Coast Range of the United States. Owing to the rugged character and few passes, the mountains form a barrier between the coast and the interior, which barrier has now been only partially overcome by the construction of railroads and highways. The Pacific Coast region differs from the western highland section of the United States in a number of striking ways. It is only about one-half as wide, with less interior plateau, with no enclosed drainage basin, and with no truly arid area. It forms about one-sixth of Canada, compared with one-third of the United States; and is mainly forested. Many streams drain the area to the Pacific, Arctic, and Hudson basins. In the south, these streams follow the parallel valleys between the mountain masses but make sharp turns, cutting through the mountains in deep canyons with many rapids and falls, making water power available in large amounts. Many long, narrow lakes, the product of glacial erosion and deposition, occur in the valleys and along the water courses. The coast is of the fiord type and is estimated to be 7000 miles long.

The region is rich in mineral resources. Coal deposits occur throughout its length, and gold, silver, copper, lead, and zinc are abundant. The great placer gold fields of the Klondike are well known.

The prevailing Westerlies bring to the coast of this region the modifying influence of the ocean. The climate varies strikingly with altitude and distance from the sea (Figs. 217 and 218). Along the coast the rainfall exceeds 100 inches, but is less than half that amount only a comparatively short distance east. The dry period occurs from May to September, and the period of heavy rain from September to March when the warm oceanic winds are blowing on cool lands of high altitude. Severe frosts rarely occur at the lower levels. These levels, west of the Selkirks, have a mild climate, where spring arrives early, and frost rarely occurs later than April, and March is distinctly a spring month. The summers are warm and the winters usually mild and rainy, especially near the coast. About 70 miles inland at Agassiz, the average January temperature is 35°, and the July average 64°, while −13° and 103° are recorded extremes. The average annual rainfall is 67 inches, two-thirds of which falls from October to March inclusive (Fig. 219).

East of the Coast Range, marked climatic changes occur. The Westerlies leave most of their moisture on the west side of the mountains, and, in descending, become warm and evaporating winds; hence the plateau between the Coast and the Selkirk ranges is dry. The summers are warm and the winters colder than on the coastal lowlands. The colder winter, however, is not severe, and the heat of summer is not unpleasant as the air is dry and the nights are cool.

In the more southerly sections of British Columbia, April temperatures resemble those of England, which bears a similar relation to water bodies, and the summers are similar to those of southern Ontario except that there is less rainfall and the air is drier.

Arctic Archipelago and Hudson Bay Lowland. This region is a continuation of the Canadian Shield and consists chiefly of the islands north of the mainland. Its basic rock structure is made up of ancient crystalline rocks, overlain by Paleozoic formations. In the west coal deposits occur in Pennsylvanian Strata. The region has a polar climate (Fig. 9), and the vegetation is the tundra type.

General Climatic Features. The climate of Canada as a whole is characterized by considerable variations due to its large land mass, diversified topography, large latitude extent, and proximity of portions of the area to water bodies.[2] The lofty mountain mass of the west is probably the most important topographic feature, as it confines the tempering influence of the ocean to the West Coast, which has the only true maritime type of climate. The interior is characterized by zero and subzero temperatures in winter and high temperatures in summer. The Pacific Coast is mild throughout the year, whereas the Atlantic Coast is mild in winter and hot in summer, the average July temperatures being similar to those of the interior. Winter rainfall is heavy on the Pacific, abundant over most of the Atlantic and St. Lawrence sections, and scant in the interior. Summer rainfall is more evenly distributed over the southern half of Canada. It is more abundant in the east and far west than in the interior, where semiarid conditions prevail in southern Alberta, Saskatchewan, and parts of the Pacific Coast Region.

NATIVE PLANT LIFE

Canada's native plant life is one of its greatest assets. Its distribution illustrates an interesting adjustment to geographic environment, particularly to varying precipitation, temperature, and soil. Since nearly all of Canada was covered by ice during the Glacial Epoch, the plant life that flourished before that time migrated southward, or northward into the unglaciated portions of Alaska, though some species were probably destroyed. As the ice receded northward, vegetation followed the ice front; hence the present native plant life is composed almost entirely of postglacial immigrants, which established themselves in provinces or zones in which the climate and soil met their special requirements. Few plants not of particular significance to man are considered here. The forests may be divided roughly into three areas: (1) the fir forest of the Pacific Coast and Rocky Mountains; (2) the northern coniferous forest extending in a wide curve from Labrador north of the Great Lakes to the Yukon; and (3) the deciduous hardwood and mixed hard- and softwood forest stretching from the Atlantic Coast through southern Quebec and Ontario to Lake Huron. It is estimated that 1,306,000 square miles are forest covered, nearly seven-tenths of which is accessible and productive forest area, and one-third carries merchantable timber (Table XVI). Some of this land is suitable for agricultural purposes, but it is probable that at least 1,100,000 square miles is best adapted to forest growth. Nearly a third of the saw timber is inaccessible under present economic conditions. For geographical purposes we may divide Canada into six plant provinces, or zones. These provinces are the Arctic; Subarctic and Northern Softwood Forest; Hardwood and Mixed Hardwood and Softwood Forest; Prairie; Rocky Mountain and Plateau; and Coast Mountains (Fig. 220).

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[2] For more detailed description, see *Canada Yearbook,* 1949, p. 41.

TABLE XVI

ESTIMATED STAND OF TIMBER IN CANADA *

	Conifers		Broad-Leaved		Totals	
	Saw Timber (Million feet board measure)	Small Timber (000 Cords)	Saw Timber (Million feet board measure)	Small Timber (000 Cords)	Saw Timber (Million feet board measure)	Small Timber (000 Cords)
Prince Edward Island	65	560	40	240	105	800
Nova Scotia	4,850	23,165	1,600	5,940	6,450	29,105
New Brunswick	6,000	50,000	3,000	30,000	9,000	80,000
Quebec	41,110	453,330	14,390	176,120	55,500	629,450
Ontario	42,560	273,790	11,390	286,140	53,950	559,930
Manitoba	855	9,645	1,620	19,110	2,475	28,755
Saskatchewan	1,850	8,920	2,100	51,060	3,950	59,980
Alberta	7,000	74,400	2,080	36,000	9,080	110,400
British Columbia	109,740	186,290	No data	No data	109,740	186,290
Accessible	214,030	1,080,100	36,220	604,610	250,250	1,684,710
Inaccessible	176,345	873,385	3,700	136,260	180,045	1,009,645
Total	390,375	1,953,485	39,920	740,870	430,295	2,694,355

* Exclusive of Newfoundland.

Arctic Province. That portion of Canada lying north of the tree line may be considered the Arctic Province. It is, therefore, a treeless region,

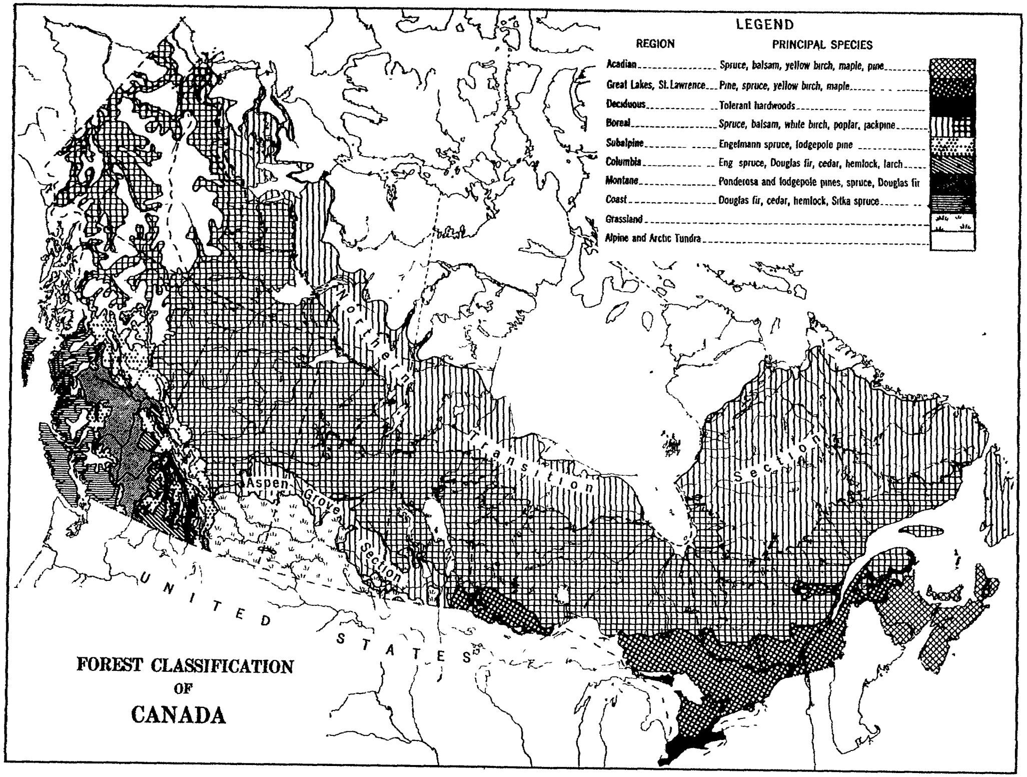

LEGEND
REGION
PRINCIPAL SPECIES
Acadian — Spruce, balsam, yellow birch, maple, pine
Great Lakes, St. Lawrence — Pine, spruce, yellow birch, maple
Deciduous — Tolerant hardwoods
Boreal — Spruce, balsam, white birch, poplar, jackpine
Subalpine — Engelmann spruce, lodgepole pine
Columbia — Eng spruce, Douglas fir, cedar, hemlock, larch
Montane — Ponderosa and lodgepole pines, spruce, Douglas fir
Coast — Douglas fir, cedar, hemlock, Sitka spruce
Grassland
Alpine and Arctic Tundra
Northern Transition Section
Aspen Grove Section
UNITED STATES
FOREST CLASSIFICATION OF CANADA

Fig. 220 The forests of Canada. *After and by Courtesy of the Dominion Bureau of Statistics.*

the southern boundary of which extends far south of the Arctic Circle, along a line extending roughly from the mouth of the Mackenzie River around the south shore of Hudson Bay to the eastern shore of Ungava Bay, and southeasterly to Hamilton Inlet in Labrador. The vegetation is low-growing or dwarfed, with the woody types often prostrate or trailing on the ground. Willows and dwarf birches are among the most prominent woody forms in the north, and members of the blueberry family in the south. Grasses, mosses, and flowers in profusion cover large areas during the short growing season, constituting a true arctic prairie. In some portions the vegetation grows in bunches similar in many respects to that of the arid regions farther south. Nearly all the plants are perennials; some go through the long winter with leaf, bud, and flower well advanced, and bloom with great rapidity the following spring. The future economic value of this region probably lies in its utilization for the production of reindeer, caribou, or muskox, though the fur industries will continue to be of importance.

Subarctic and Northern Softwood Forest Province. The southern boundary of this region extends southward and eastward from where the Arctic Circle crosses the Alaskan boundary, along the foothills of the Rocky Mountains, the northern border of the prairies to the southern end of Lake Winnipeg, and across the Gaspé Peninsula to southern Labrador, including Newfoundland. This boundary is also practically the northern limit of white and red pine. The province is dominantly a coniferous forest area with a striking uniformity in species and general character. The trees are relatively small in size, and there are comparatively few species. Black and white spruce predominate. Among other trees are the Banksian pine, which supplies lumber to the prairie section, aspen, balsam poplar, white birch, larch, and balsam fir. The province is largely unsettled at the present time, but the pulp and paper industry is now entering the area.

Hardwood and Mixed Hardwood and Softwood Forest Province. This province includes that portion of Canada south of the Northern Softwood Forest which lies east of the southern end of Lake Winnipeg. It is characterized by deciduous trees, the principal ones being yellow birch, basswood, sugar maple, red maple, black ash, white elm, red oak, burr oak, hickory, and beech. A few coniferous trees, such as white and red pine, hemlock, and white cedar, are scattered through the forest and increase in relative numbers northward. The abundant moisture and fairly long growing season provide for a luxuriant growth of plant life. Extensive lumber and pulp indusrties are now carried on in this province.

Prairie Province. The Prairie Province extends from the foothills of the Rocky Mountains on the west and the Subarctic province on the north to the Hardwood Forest province on the east. It includes the grassland areas of Alberta, Saskatchewan, and Manitoba. The vegetation cover varies with the rain and snow supply, being more luxuriant in the east and varying to the semiarid and arid types in the west, where in the foothills it mingles with the Alpine types of the Rockies. The quantity of vegetation in any given season bears very close relation to the abundance of rainfall, and the snow supply of the preceding winter. If these supplies are small, vegetation will be sparse, but if the moisture supply is abundant, vegetation will likewise be abundant. Along the streams of the first prairie level there are a few trees, such as ash, elm, poplar, and Manitoba maple; but the area is treeless away from the streams. Poplar and oaks occur along the escarpments, but the major part of the second prairie level is a grass-covered steppe, though shrubs occur in thickets. The third prairie level is treeless, except on Wood Mountain and Cypress Hills, and the vegetation is scant and desertlike in appearance and character, many of the plants being of the drought-resisting type. This province is dominantly an agricultural and grazing country.

Rocky Mountain and Plateau Province. This includes the Rocky Mountains on the east and extends to the Coast Mountains on the west. There is considerable variation in the native plant life of this region; in fact, the region might be divided into the Interior Wet Belt province and the Interior Dry Belt province. The Rocky Mountain province is mainly covered with coniferous forest except on the higher slopes, the principal trees being the lodgepole and white bark pine, white spruce, balsam fir, and larch. Above the tree line there are many species of herbaceous vegetation, including many brightly colored flowers characteristic of Alpine regions. Many of these species are also found in the Arctic province. The Interior Wet Belt has more moisture than the Rocky Mountains, and the alpine meadows extend to the snow line. The dominant trees are cedar, Douglas fir, hemlock, and Engelmann spruce. The Dry Belts include the Okanagon and Kamloops districts, within which there is considerable variation. One section has bunchgrass of "wild rye" and no forest; the second section has limited forests of yellow pine. In general, the Dry Belts have a parklike character with desert ground vegetation.

Coast Mountain Province. This province contains many species not found elsewhere in Canada, although it also has a large number of species common to the Selkirk region. Because of the high average temperature, heavy rainfall, and long growing season, the vegetation of the coast and lowland valleys approaches a sutbropical appearance in its luxuriance and growth. In many undisturbed sections, fallen trees, shrubs, ferns, and other herbaceous plants form almost a jungle. Even where the forest stand is dense, the undergrowth is abundant; and, along the coast, grass grows luxuriantly. Douglas fir, Sitka spruce, red cedar, western hemlock, red alder, and broad-leaved maple are the principal trees. The Douglas fir, cedar, and spruce reach a size that may be truly described as gigantic. The Douglas fir attains a height of 300 feet and a circumference of 50 feet, and is distributed over most of southern British Columbia, but disappears about 50° north latitude. The largest trees occur on Vancouver Island and along the mainland coast. The lumber resources of this particular province are very large.

FOREST INDUSTRIES

Forest Products. The forest resources are among the greatest held by any country in the world. Forest products rank next to those of agriculture in value. Sawmill and pulpmill products are the most important and are nearly alike in value. Other leading products are pulpwood, logs and bolts, firewood, mine timbers, poles, and squared timber for export. British Columbia leads in sawmill products, followed by Quebec and Ontario, the three producing more than four-fifths of the total. New Brunswick and Nova Scotia rank next in order.

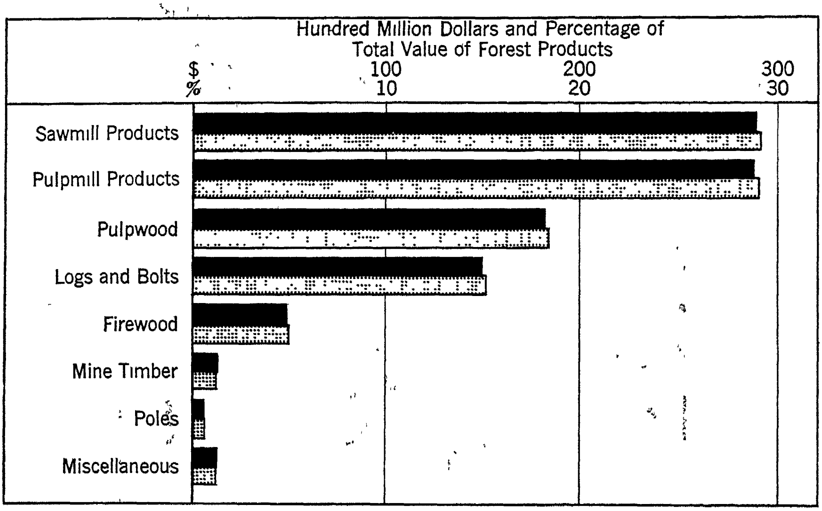


Fig. 221. Principal forest products of Canada. Three-year average.

The rise of woodpulp and paper manufacture to the rank of a major industry is relatively recent. The first pulp mill is said to have been erected in 1866. Fourteen years later, 5 pulp mills were in operation, and 24 in 1891. Since then the industry has experienced a rapid growth. At

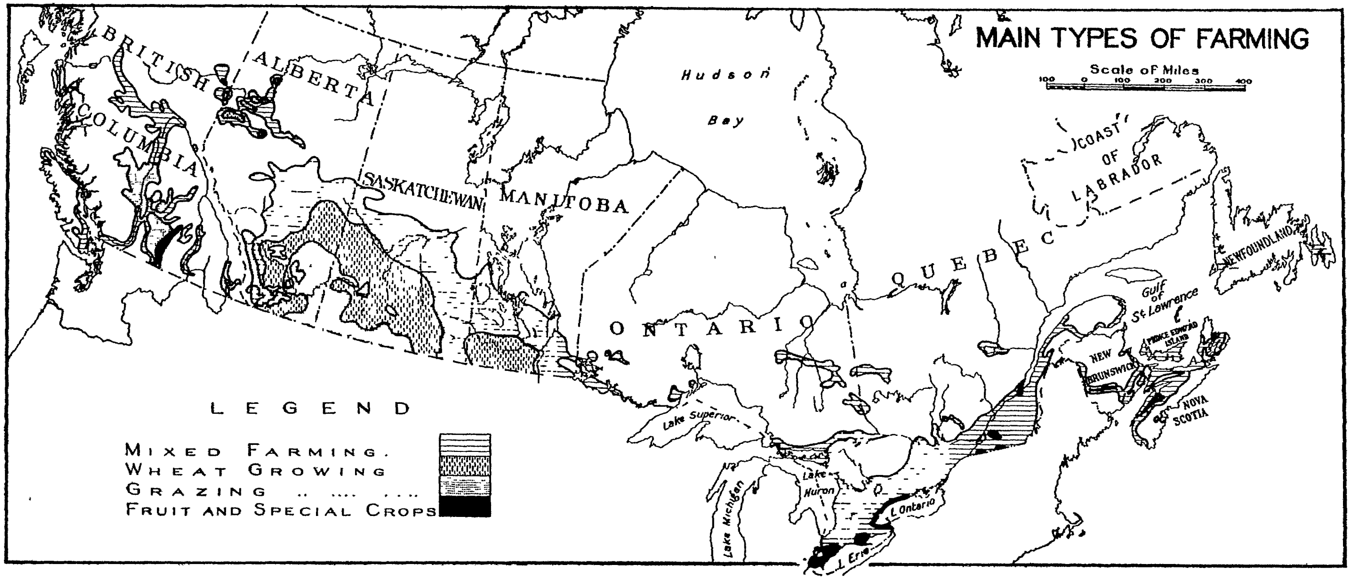


Fig. 222. Main types of farming in Canada. The East is predominantly a land of mixed farming and dairying, and the West a land of grain growing, especially wheat, and of ranching. *Courtesy, Dominion Bureau of Statistics.*

present, 113 mills are engaged in the production of pulp and paper. This development is due primarily to the coexistence of abundant water power and great resources of the species of trees best adapted to present processes of pulp manufacture. Probably only slightly less important is the proximity of excellent markets in the United States. Pulpwood, which is now second in rank among the primary forest products, is produced from spruce, balsam fir, hemlock, poplar, and Jack pine, most of it being derived from spruce. Quebec and Ontario lead in woodpulp production, yielding four-fifths of the total output. The paper-making industry grew rapidly during the 1940's and early 1950's, and Canada has become the world's leading producer of newsprint—nearly three-fifths of the world output. All but a small fraction is produced in Quebec and Ontario. The pulp and paper industry has now become one of the leading manufacturing industries of the Dominion.

Surplus Produced. With the vast forest resources, one would expect the people to produce more than was needed for home consumption. The exports of forest products rank next to the exports of agricultural products. The United States and the United Kingdom are the principal markets, nearly seven-tenths of the exports going to the United States. The United States receives annually all of Canada's exports of pulpwood and more than four-fifths of its woodpulp and newsprint. More than half of the newsprint paper consumed in the United States yearly is either manufactured in Canada or is made from imported Canadian pulpwood and pulp. Owing to the depleted condition of its forests, the United States may be considered as not only the greatest present market, but also a permanent one, for Canada. As the vast forest resources of Canada have scarcely been touched at present, they may be expected to make a large contribution to the economic welfare of the Canadian people. It has been said that in no other country do "forests play a more vital part in sustaining the industries of the country."

FOOD PRODUCTION

Agriculture

Agriculture is second among the leading industries, measured by value, but it gives employment to many more people than any other industry. More than a quarter of the people in gainful occupations depend upon it. It is limited almost entirely to the southern border, where there are large areas of virgin, fertile soil, with favorable climatic conditions for hardy grains and fruits, hay and forage, and root crops. The crop acreage of Saskatchewan is larger than that of any other province, and is followed by Alberta, Ontario, Manitoba, and Quebec. Measured by value of field crops produced, Saskatchewan, Ontario, and Alberta, in order, are the leading agricultural provinces, and their combined revenue forms more than two-thirds the total of Canada. The crop map (Fig. 222) emphasizes the fact that agriculture is confined to two major regions, the Great Lakes-St. Lawrence Lowland and the Prairie Plains. Two minor agricultural sections are the Maritime Provinces and the Pacific Mountain Region. The leading crops of Canada, shown in Fig. 223, clearly indicate present land use. Nearly all (98.7 per cent) of the cropland is used to produce nine crops. However, three-fifths is devoted to wheat and oats alone, and another fifth to hay crops. Hay and forage (both cultivated and wild hay) are a very important Canadian crop, exceeding any other crop, except wheat, in value.

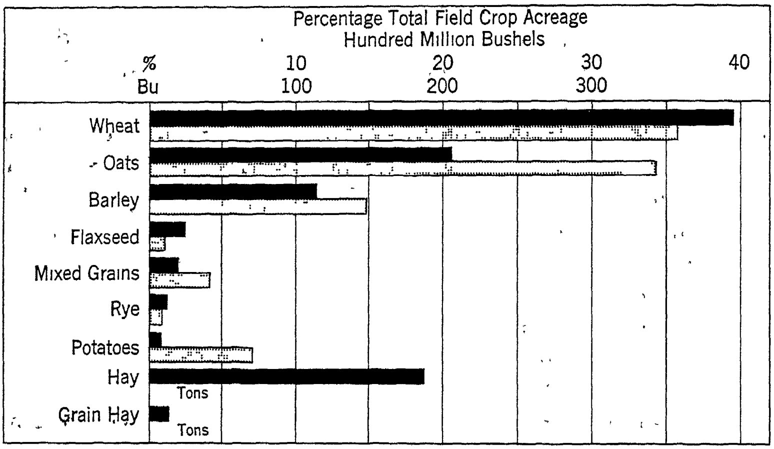


Fig. 223. Principal field crops of Canada. Three-year average. These nine crops occupy nearly all (98.7 per cent) of the cultivated land of Canada.

Livestock. The principal livestock raised on Canadian farms are cattle, swine, sheep, and poultry. The total number is small in comparison with the number of livestock in the United States, but it compares favorably with leading single states. As cattle are raised on nearly every farm, their distribution corresponds fairly closely with the agricultural area. Nearly half the cattle, however, are confined to the Great Lakes-St. Lawrence Lowland and the adjoining margin of the Canadian Shield, where dairying has been making rapid progress. Butter and cheese are the leading products of the dairy factories. Dairying has also become a very important industry in the Prairie Plains.

Surplus Produced. Canada now produces a surplus of a number of food products. This is especially true of grain and animal products.

Wheat and wheat flour constitute the largest items in the grain group. Dairy products stand first among the animal products, followed by meats. This indicates that the people of Canada are producing annually considerably more than is needed for their own consumption, and raises the question of present and future land utilization.

Agricultural Area. Only a small portion of the land area of Canada is now used for crop production. The occupied farm land is one-half of the potential agricultural land, and the crop average is less than one-fourth though it has made a substantial gain.

TABLE XVII

Occupied and Potential Agricultural Land in Canada *

	Land Area (square miles)	Occupied		Total Potential Agricultural Land		
		Square Miles	Per Cent of Potential	Square Miles	Per Cent of Total Potential	Per Cent of Land Area
Prince Edward Island	2,184	1,826	92.6	1,970	0.3	90.2
Nova Scotia	20,743	5,963	47.1	12,640	2.4	60.9
New Brunswick	27,473	6,194	36.9	16,750	3.1	60.9
Quebec	523,860	28,222	42.3	66,615	12.5	12.7
Ontario	363,282	34,981	34.0	102,870	19.3	28.3
Manitoba	219,723	26,393	52.1	50,590	9.5	23.0
Saskatchewan	237,975	93,689	74.9	125,080	23.4	52.5
Alberta	248,800	67,621	49.4	136,640	25.6	54.9
British Columbia	359,279	6,302	30.4	20,700	3.9	5.7
Total	2,003,319	271,191	50.7	533,855	100.0	26.6
Yukon and Northwest Territories	1,458,784	4		14,069	2.5	0.9
Total	3,462,103	271,195	49.4	547,924		15.8

* Newfoundland and Labrador are not included because available data are inadequate.

It is not possible to state the potential agricultural area with any great degree of accuracy. Nevertheless, available figures are sufficiently accurate to show large agricultural possibilities, and to assure a food-producing capacity sufficient to maintain a much larger population. Canada has an estimated arable area of approximately 341,670,000 acres, or about a fourth of the total area, exclusive of the Northwest and Yukon Territories, which have little or no crop value, or which are not likely to be used for crop production until the more desirable land elsewhere is utiilzed. The arable land of Newfoundland might add 20,000 or 30,000 acres to the total. The potential acreage varies from 6 per cent of British

Columbia to 90 per cent of Prince Edward Island. The distribution by provinces is shown in Table XVII. Nearly half the potential agricultural land is in Saskatchewan and Alberta, and nearly a third in Quebec and Ontario.

FISHERIES

The First Industry. Fishing was the first industry to be followed systematically by Europeans in what is now the Canadian domain. When Cabot first sighted the North American mainland in 1498, he named it "Bacalaos," the Basque word meaning codfish. It was the early French fishermen who contributed the familiar name Cape Breton. Many other names stand as memorials to the pioneers on Canadian fishing grounds. The French, Spanish, and Portuguese were there before 1502, plying their trade in the primitive manner of the time. Though the fishing industry got an early start, it remained small for more than three centuries. Its principal growth has occurred comparatively recently. In 1844 the value of the catch was only about $125,000; by 1860 it was somewhat in excess of $1,000,000; and 10 years later it amounted to $6,000,000. Today the industry is conducted on a large commercial scale on the Atlantic and Pacific Coasts and in inland waters. It yields products worth $121,125,000 and gives full-time employment to 36,400 people, four times as many being engaged in the sea fisheries as in the inland fisheries.

Inland Fisheries. The inland fisheries are small compared with the sea fisheries of either coast. Nearly two-thirds of the total catch is taken in Ontario. Whitefish, the most important inland commercial fish, is found in the Great Lakes, Lake Winnipeg, and its tributaries. Others are pickerel, trout, goldeyes, and pike.

Surplus. The production of fish products greatly exceeds the home demand. The value of the exports is more than two-thirds of the total value produced annually. The United States and the United Kingdom are the principal markets, more than seven times as much going to the former as to the latter. The other important markets are the West Indies, France, Australia, and Brazil.

MINERALS

Distribution and Production. Scattered over the large area of Canada, minerals occur in great variety. Those that may be considered critical in the development of modern nations, viz., coal, oil, and iron, are unfavorably distributed as they are on or near the Pacific and Atlantic margins of the country. So far as a survey of mineral resources is concerned, only the southern portion of Canada is known, and that only partially. Minerals are known to exist in isolated places over the vast stretch of northern Canada, but little more is known about them. Minerals were among the first of Canada's resources to be recognized as of importance. Iron, silver, copper, and amethyst were discovered as early as 1604, and coal was known by at least the last quarter of the same century. Development of minerals on more than a local basis did not occur until many years later. The growth of mineral production has been gradual, and today the mineral industries make a large annual contribution to the wealth of Canada and occupy the attention of many people. The production of minerals is widespread throughout Canada, operations being conducted from British Columbia to Newfoundland and northward into Arctic lands. However, more than half the value of minerals produced annually is contributed by Ontario and Quebec.

The average annual value of the mineral production of Canada is nearly $500,000,000. Measured by value gold leads, followed by copper, coal, and nickel. The nine minerals shown in Fig. 224 contribute more than four-fifths of the annual mineral production.

Coal. The coal resources of Canada are very large if all kinds of coal are considered. Nearly half the total is in Alberta and is practically all bituminous and anthracite. Other valuable deposits of anthracite and bituminous are in Nova Scotia, New Brunswick, and British Columbia. It is apparent that the great coal resources of Canada are very unfavorbly locted, from the standpoint of human use, under present conditions. Their position in the far east and the far west, separated by the coalless

TABLE XVIII

ESTIMATED COAL RESERVES OF CANADA

	Probable (000 tons)	Percentage Bituminous and Anthracite	Possible (000 tons)	Percentage Bituminous and Anthracite	Percentage Total Probable and Possible of Canada	Percentage Total and Probable Possible Reserves of Bituminous and Anthracite
Alberta	34,437,740	100.0	13,436,560	99.9	48.4	66.7
Saskatchewan	13,126,880	nil	11,004,000	nil	24.4	nil
British Columbia	11,795,480	98.7	7,034,556	98.3	19.0	25.8
Nova Scotia	1,967,024	100.0	1,147,382	100.0	3.1	4.3
Yukon	434,500	25.7	1,449,840	14.5	1.9	0.45
Northwest Territories	140,000	21.6	2,489,760	68.1	2.6	2.4
Ontario	100,000	nil	50,000	nil	0.1	nil
New Brunswick	89,814	100.0	11,566	100.0	0.1	0.14
Manitoba	33,600	nil	67,200	nil	1.0	nil
Total	62,125,098	77.8	36,690,864	63.8	100.0	100.00

Canadian Shield, leaves the Great Lakes-St. Lawrence Lowland, where most of the people live, dependent upon the United States for most of its coal, as transportation costs prevent the use of Canadian coal. Nearly three-fifths of the production is in Alberta and British Columbia, and more than 30 per cent in the Maritime Provinces. This places the effective production on opposite sides of the country. To meet the needs of the more densely settled and industrial Lowlands, Canada imports two-thirds of the coal it consumes annually. Some British Columbia coal finds a market along the Pacific Coast of the United States, and some of the Nova Scotia coal goes to New England.

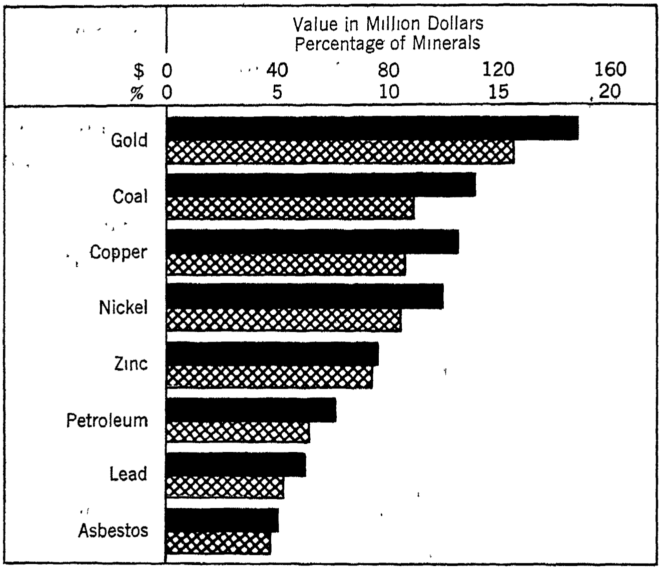


Fig. 224. Principal minerals produced in Canada. These eight account for more than three-fourths of the value of all minerals produced in Canada.

Surplus. The mining industry has reached a stage where a net surplus of some minerals is available for export. Precious metals (gold) lead the list, followed by asbestos and nickel. The production of asbestos and nickel constitutes most of the world's supply.

MANUFACTURES

Growth. The growth of manufacturing industries in Canada has been slow compared with that in the United States and in other countries having greater population. However, the growth has been steady during the last half century. In 1870, less than 200,000 people were employed in manufacturing, and the number now exceeds 1,150,000. During the first half of the nineteenth century, manufacturing was mostly of the household type. The so-called "Industrial Revolution," or development of the factory system of production for a national or international market, commenced shortly before Confederation (1867), and is still in progress. World War I accelerated production profoundly, and its influence continued to World War II, which stimulated manufacturing development still more. Many of the large industrial establishments are subsidiaries of United States corporations. These branch plants avoid Canadian import tariffs for the home market and gain preferential tariff rates to other parts of the British Empire. A large-scale organization of industries is not widespread at present, but has begun and will probably increase with an increase in population that gives a market to large amounts of standard products. Also, production for international markets is now well established. Canada's exports to British Empire countries are largely manufactured products, and the exports of manufactured and semimanufactured goods to the United States are larger than the exports of raw materials.

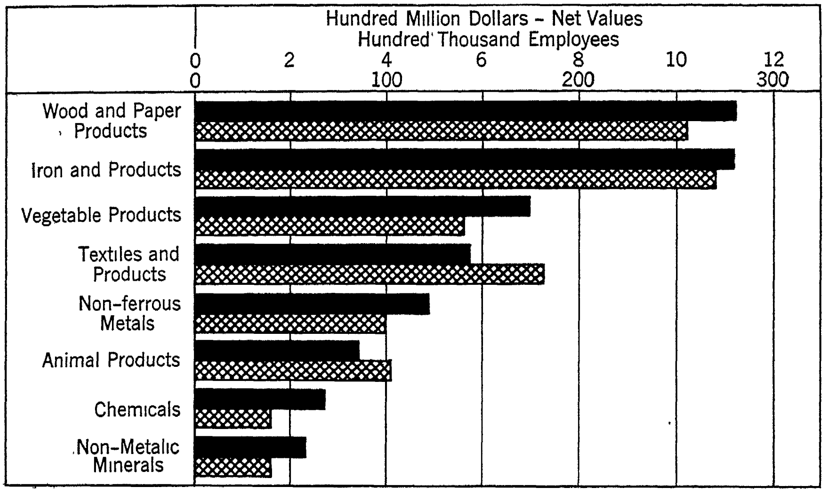


Fig. 225. Manufacturing by leading industrial groups. With the exception of textiles, Canadian manufactures are based primarily upon the utilization of domestic raw materials Forest industries lead net value of products, but the iron industries give employment to more people.

Canada's manufacturing industries (Fig. 225) are built chiefly upon the use of domestic raw materials and a home market for the finished products. There is a tendency to import raw materials to supply manufactures not only to home markets but also to world markets. This is shown by the imports of raw cotton from the United States, hides from Argentina, rubber from the Straits Settlements and Malay Peninsula, sugar from the West Indies, wool from Australia and New Zealand; and by the exports of manufactured articles. True measures of the importance of manufactures are the value added by the manufacturing process and the number of people employed, but, since fluctuation in prices greatly lessens the significance of value added by manufacturing, both measures are used in the following discussion.

Principal Industries. The leading groups of manufactures measured by net value are wood and paper, iron and steel, and vegetable and textile products. However, the iron and steel industries rank first in the number of people employed, and textiles third. The high rank of the iron and steel group is indicative of the industrial evolution that is taking place, as much of the raw material is imported. Both iron ore and coal are imported, as domestic production is inadequate, and suitable coal is unfavorably located. However, Nova Scotia produces coal to smelt ore from Newfoundland.

The first six leading individual industries, measured by product value, are pulp and paper making, meat packing, smelting of non-ferrous metals, sawmilling, flour and feed milling, and butter and cheese making, and are based on local raw materials from forest, farm, and mine. The seventh—electrical equipment and supplies—is based upon the great water-power resources. The high position of this industry is suggestive of the absence of coal in the regions where it is greatly needed, and of the effort of the Canadian people to solve this problem by utilizing one of their resources.

Distribution. Ontario and Quebec are the leading industrial provinces, as they produce four-fifths of the manufactures (net value) of Canada and have a like proportion of employees. Iron, and coal for manufacturing purposes, are imported very largely from the United States, since the coal of the Maritime provinces and the iron from Newfoundland are too distant to compete. The development of water power to supplant coal is progressing rapidly in this region. Four-fifths of Canada's industry is now operated by electricity. All other provinces are of comparatively small importance in manufacturing.

As the growth and prosperity of cities are intimately associated with the development of manufactures, the localization of manufacturing becomes of great interest. The 6 leading manufacturing metropolitan areas are Montreal, Toronto, Hamilton, Vancouver, Windsor, Winnipeg—4 of which are in the Great Lakes-St. Lawrence Lowland. Nearly one-half of the manufacturing industry of Canada is concentrated in these 6 areas, whether measured by net value or by number of employées (Fig. 226). However, there is a marked difference in their relative rank. Montreal and Toronto are the premier industrial cities and hold a commanding position over all others. Those two areas alone contribute nearly one-third of the net value of Canada's manufactures. All other cities are of relatively small importance although each is of considerable significance locally. *What factors have contributed to the growth of industry in these cities? Can Canada become one of the leading manufacturing countries of the world?*

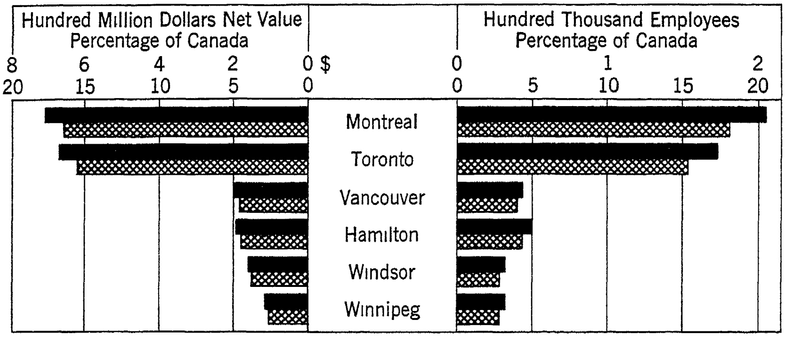


Fig. 226. The six leading manufacturing metropolitan areas of Canada.

TRANSPORTATION

Railroads and Highways. Canada's broad expanse of territory, the large extent of area with very small production, and the 13,200,000 people scattered along its southern border present a big problem of transportation and communication, a problem that must be solved before the resources of large portions of the country can be developed. The productive parts of Canada are separated from each other by areas of wilderness, e.g., the region between Quebec and New Brunswick; and the area north of Lakes Superior and Huron, separating the industrial region of the Great Lakes-St. Lawrence Lowland from the agricultural region of the Prairie Plains. In a country like Canada, with its sparse population, a western agricultural section that produces mainly for export, and an eastern manufacturing section that produces largely for consumption in distant parts, efficient transportation is a necessity. When Canada depended upon water routes for transportation, its economic life practically stood still during the season when its waterways were closed by ice.

Railways are the fundamental means of modern land transportation and must precede settlement in the present age. This necessity has led to the extension of government aid to private railroads in order that they might be built through sparsely settled districts with little available traffic, or in advance of settlement. The first railway was built in 1835, but the railway era began in 1851. At that time there were only 66 miles of railroad in Canada. Since then the main mileage has been expanded to 42,300, exclusive of 700 miles of narrow gauge in Newfoundland, which is a creditable growth when one considers the small population of the country. Much of this growth has been brought about through government aid or construction, 21,556 miles now being owned and operated by the Dominion Government. About one-fourth of Canada's railway mileage is in Ontario. The Dominion now has three transcontinental lines, one the Canadian Pacific, and two of the Canadian National Railways. It is probable that immediate future growth will consist of the construction of a network of feeders to these main lines in order better to serve and develop the country now open for settlement.

Highways probably rank next to railways in making occupancy and development of a country possible. To provide highways adequate to serve such a large area, having only a few people, is a very expensive undertaking. Relative to the area the 554,000 miles now in use appears very small; however, the southern portion, where most of the people live, may be considered well served. The trans-Canada highway makes it possible for motor vehicles to traverse the country from Halifax to Vancouver. The Alaska Highway gives access to the Northwest.

Canals. Before the railroad era, the St. Lawrence and Ottawa Rivers and Great Lakes were the principal avenues of transportation. However, portages were necessary along these routes; hence canal construction has been designed as a means to overcome these obstacles. The canals of Canada may be placed in four groups: (1) the St. Lawrence and Great Lakes groups, consisting of nine canals, including the Welland and Sault Ste. Marie, which are of first importance; (2) the Ottawa and Rideau Rivers group, consisting of four canals; (3) the Richelieu River group, having two canals; and (4) a miscellaneous group, consisting of Trent, St. Peter's and St. Andrew's Canals. Collectively they provide 509 miles of navigable waterways, though their relative importance is not to be measured by their length. Most of the canal traffic occurs during the summer and fall months, and consists chiefly of bulky or heavy mine products, such as coal, and farm products, especially wheat.

Airways. A network of government and privately owned airlines provides passenger and cargo service to southern Canada. The main lines extend across the country from east to west, and other lines serve the north country to Yukon, Labrador, and the Arctic. In addition, charter service is available to many sections of the country otherwise inaccessible. The mileage flown has reached the impressive figure of 26,000,000, the number of passengers carried more than 800,000, and the freight poundage 25,000,000.

Other Means of Communication. The telegraph, telephone, wireless, and mails are probably of only slightly less importance than railroads, highways, and airlines in tying together the widely scattered settlements of the country and making effective its economic life. The first telegraph line was built in 1846; telephone development dates from 1880; and scores of radio-telegraph stations have been installed since 1903. Government and private systems now extend throughout the settled areas and reach many remote points of the Dominion.

FOREIGN TRADE

Growth. Canada's foreign trade experienced a steady growth until the beginning of World War I, when the closing of old avenues of world trade and the opening of new ones brought about rapid development. Until the time of this rapid growth, imports had considerably exceeded exports; but with the stimulus of high prices and war production this situation was reversed, and so continued until about 1921. The decline in trade during the next year shows the influence of the contraction of industry and world trade following war conditions. World War II again stimulated production and trade, which have continued to grow to meet world demand for products. With only about 0.5 per cent of the world's population, Canada now ranks as one of the top trading nations. In a country like Canada with a small population, a high living standard, large resources, and production of basic commodities, foreign trade is vital to domestic economy. Approximately a third of the national income is derived from foreign trade. *What basal factors favor future growth in foreign trade?*

Character of Trade. The home produce that enters Canadian commerce is the product of its farms, forests, mines, and seas. For many years Canada was primarily a seller of raw and partly manufactured material and a buyer of manufactured articles. This is likely to be true of new countries in their earlier stages of economic development. However, with the United States market for forest products, and the growth of manufacturing plants, a change in the character of Canada's trade is now in progress. Manufactured forest products—newsprint paper, lumber, and woodpulp—now lead in the export trade, with wheat and wheat flour ranking second. Fully half the total exports are now fully manufactured products, and a quarter are semimanufactured. Major imports are still manufactures with machinery, of all kinds, in the lead. The outstanding raw material imported is coal, to meet a deficiency which Canada cannot supply. About seven-tenths of all imports are fully manufactured goods (Fig. 227).

Countries with Which Canada Trades. Two countries buy from Canada considerably more than half of all it has to sell, and sell to it nearly all that it buys. More than a third of all its exports are purchased by the United States, and more than a quarter by the United Kingdom. More than three-fourths of its imports come from the United States; hence the economic welfare of its people is linked closely with conditions prevailing in those two countries. Among the many factors that contribute to the dominance of the United States in Canadian trade are: a common language; proximity and free movement of people; minimum of exchange problems, growth of subsidiary or branch manufacturing plants of United States in Canada; influence of United States radio, magazines, and extensive advertising; and the great demand in the United States for Canadian forest products, especially woodpulp and newsprint paper. The balance of Canadian trade is widespread throughout the world, and includes British West Indies, South Africa, Australia, India, Argentina, Brazil, Venezuela, and many European countries. Foodstuffs, especially wheat

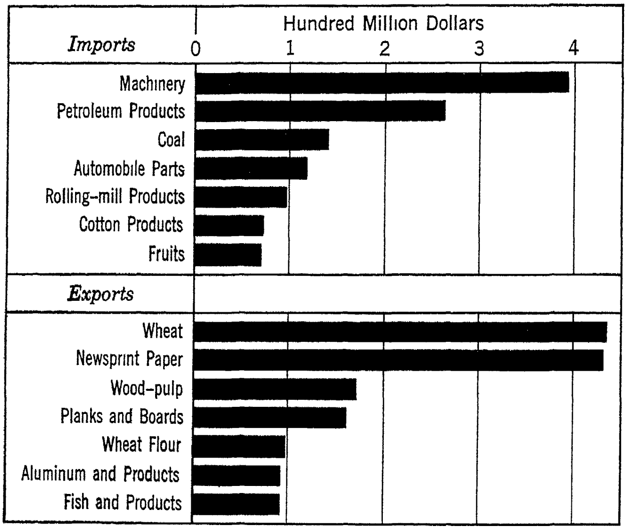


Fig. 227. Trade of Canada by leading products.

and flour, are the major products that go to the United Kingdom (Fig. 228).

Foreign Trade by Regions. The foreign trade of Canada may conveniently be divided into four principal trade regions. The Quebec and Ontario region, which is essentially the Great Lakes-St. Lawrence Lowland, is by far the most important, having more than half the total foreign trade. The principal ports are Montreal, Toronto, Cobourg, Fort William, Port Arthur, and Sault Ste. Marie. This is the region with most of the population, large production, excellent inland transportation, good harbors, and accessibility to the great markets of western Europe. The Maritime Provinces rank second, British Columbia third, and the Prairie Plains and Arctic fourth. Halifax, Saint John, Sydney, and Saint John's are the dominant ports for the Maritime Provinces; Emerson, Churchill, and North Portal for the Prairie Provinces; Vancouver and Victoria for British Columbia. The Maritime Provinces and British Columbia have excellent water outlets, whereas the commerce of the Prairie Provinces must depend upon extensive inland transportation, and transhipment to the Great Lakes.

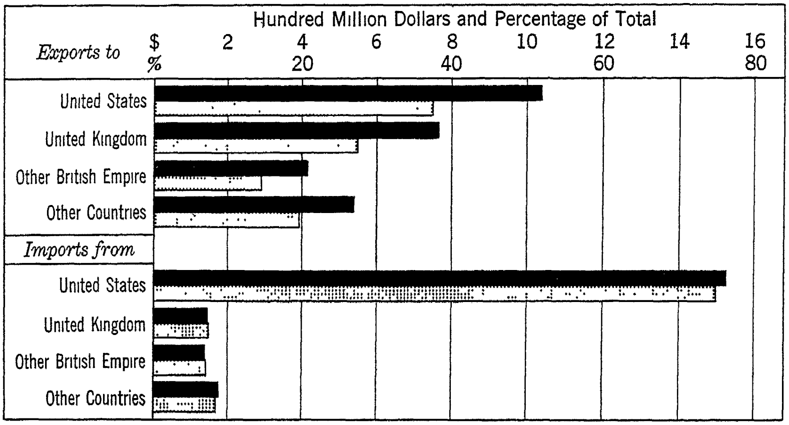


Fig. 228. Canadian trade by principal countries. Three-year average.

THE FUTURE

The northerly location of Canada, its climatic limitations, erroneous conceptions of its resources, and the known opportunities offered by the United States determined that its development should be delayed until the more enticing opportunities offered the immigrant in the United States became fewer. That a region with such extensive forest, mineral, water, and sea resources should eventually attract a population and develop transportation, commerce, and manufactures, was inevitable, though such development has scarcely more than made a start. Today the cultivated land and food production per capita ranks among the highest in the world, whereas the potential agricultural land of Canada is capable of providing food and homes for several times the present population. Its vast forest resources have scarcely been touched, though they now engage the attention of many people. Great varieties of minerals are known to exist, and most of the country still remains to be examined. All these resources may supply raw materials to manufacturing industries, which are yet in their infancy, and its streams, petroleum, natural gas, and coal may supply the power. The development of these industries should result in the expansion of transportation and wider extension of commerce to world markets, and should advance settlement to habitable areas now unpeopled. Thus Canada stands today as a nation looking forward to a more intensive utilization of its geographic resources, and to the time when many more people will find homes within its borders. *Has it a sound foundation upon which to build? What have the people done in its geographic regions thus far, and what may they do?*

PROBLEMS

1. Will Canada become the most important unit in the British Empire?
2. Have the people of Canada attained more than half the industrial development possible?
3. Is it probable that Canada can produce four or five times its present agricultural output?
4. Can Canada become one of the three or four leading manufacturing and commercial nations of the world?
5. Are the natural assets of Canada more favorable to the evolution of a strong and prosperous nation than are those of either Brazil or Argentina?
6. Are the natural resources favorable to the maintenance of three or four times as many people as now live in Canada?
7. Do the natural resources of Canada make it as desirable a home for man as that part of Europe which lies within the same latitudinal limits?
8. Is Cnada at least half as favorable as a home for man as the United States?
9. Arrange the following items in order of their relative importance in the present and future development of Canada: (1) type of human human stock, (2) minerals, (3) climate, (4) rivers and lakes, (5) topography, (6) soil, (7) coast, (8) location, (9) forests.
10. Why have the Great Lakes been of less importance to Canada than to the United States?

CHAPTER 21

The Maritime Provinces

The Maritime Provinces have been aptly described as the "land that was passed by." Though the first settlement in Canada was established in Nova Scotia, and though the provinces are supplied with resources, they have remained essentially static. During the period of early settlement the flow of immigrants "passed by" to the more promising interior lands. Hundreds of miles of uninhabited forest separate the region from the more densely peopled St. Lawrence Lowland and Ontario Plains; and the St. Lawrence—the national highway—is closed by ice for half the year. Even the Intercolonial Railway, which passes north of Maine in order to remain in Canadian territory, is used but little and is operated at a loss. Only the coastal fringe of Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland are at all densely populated. People are more evenly distributed over Prince Edward Island than any other Province. Prince Edward's gently rolling surface, dotted with comfortable rural homes, presents a pleasing agricultural landscape. A large part of the interior of New Brunswick, Nova Scotia, and Newfoundland is very sparsely settled. Large areas are uninhabited.

In general the surface is mountainlike, with the highlands, lowlands, and large coastal indentations trending northeast-southwest in conformity with the Appalachian system. A large part of New Brunswick and Prince Edward Island has an average elevation of only a few hundred feet, but it is by no means flat. In northwestern New Brunswick is a broken, highly hilly district reaching an elevation of 2500 feet, and a similar plateaulike country borders the Bay of Fundy. The central ridge of Nova Scotia reaches an elevation of 1500 feet in Cape Breton Island. Aside from Prince Edward Island, which is mostly arable, the region contains many more or less isolated fertile areas, though it is essentially a rugged, hilly country. Among these productive areas are the Annapolis-Cornwallis Valley in Nova Scotia and the St. John Valley in New Brunswick. Much of the region is forest covered and is traversed by many streams. The coast line is long and, with its many good harbors and shallow offshore waters teeming with fish, has wielded a strong influence in the development of the region.

The region has abundant rainfall, and sufficiently long and warm summers to mature all temperate fruits and other crops and produce a luxuriant growth of native forest. Though it is located in the latitude of southern France, the winters are cold, owing chiefly to the cold continental northwest winds, and secondarily to the onshore winds from the Labrador Current.

Many minerals of economic value occur. Coal is abundant. Probably few places in the world possess conditions as favorable for the manufacture of iron and steel as are found on Cape Breton Island where coal is mined at tidewater. The steel mills are located on the harbor at Sydney, and the ore and limestone are obtained by a short voyage from Newfoundland where it is mined at tidewater. New Brunswick likewise has extensive coal deposits. Other minerals now in production include barites, gypsum, silica, sand and gravel, zinc, lead, copper, gold, salt. The salt mine near Malagash, Nova Scotia, is said to be the only one in Canada. However, salt is produced by pumping and evaporation near Amherst.

The present relative backwardness of the region is due only in part to geographical factors. Difficulties of transportation, except by way of the Atlantic, the "patchy" character of good soil areas, and rugged surface are serious handicaps, but it is likely that unfavorable United States tariffs are a greater disadvantage. The resources and location of the region bring its products into competition with those of New England. If reciprocity existed, it is probable that industrial development would take place. *What would have been the history of the Maritime Provinces had the international boundary been located along the St. Lawrence River?*

UTILIZATION OF FOUR PRINCIPAL RESOURCES

Agriculture. The agricultural areas and present development are related closely to the geological structure. Fully three-fourths of the agricultural land is on Carboniferous and Triassic formations near the coast, has fertile soils, and is low and sheltered. Prince Edward Island, the diked tidal marshes at the head of the Bay of Fundy, and the Annapolis-Cornwallis Valley typify the better agricultural lands. Other fertile areas occur on similar rock formations, in New Brunswick and Cape Breton Island, on the alluvial bottoms of numerous river valleys, and in patches on the higher lands. The total potential agricultural land is estimated to be 20,100,000 acres. However, much of the acreage is covered with forests and is remote from transportation, and other areas must be drained or diked. Agriculture is most developed on Prince Edward Island—a land of agriculture, fishing, and fur farming. Over nine-tenths of its area is arable, and nearly three-tenths of the arable land is now in crops. About 60 per cent of the land area of New Brunswick and a like proportion of Nova Scotia is arable, but only about 1 per cent of these lands is cultivated. The agricultural potential of Newfoundland is very small.

Except on Prince Edward Island, agricultural development is still in its infancy (Fig. 229). Sixty-five per cent of the acreage in field crops is devoted to hay, and nearly one-fifth to oats, which is indicative of livestock raising and the production of dairy products. Cattle are more widely distributed than any field crop unless it is hay, but few are raised on the relatively unsettled, hilly, crystalline uplands. Other important crops are potatoes, fruit, and mixed grains. The Annapolis-Cornwallis Valley, known as "The Garden of Nova Scotia," and celebrated for its apples, extends from the Bay of Minas to the head of Annapolis Basin. It is about 80 miles long and from 10 to 15 miles wide. North Mountain separates it from the Bay of Fundy and gives protection from the northwest winds and fogs, and South Mountain forms the other side of the valley. Only about one-tenth of the valley is under cultivation. The warm winter winds from the Bay of Fundy produce a pronounced moderating effect, the average winter temperature of Annapolis being 5°–6° higher than that of Halifax. The bay likewise affords protection from killing frosts in spring and fall, giving the valley a long growing season. Even on very still nights during the critical danger periods, the air movements created by the exceptionally high tidal range of the bay constitute an additional factor in protection from frost. Another important advantage possessed by the valley is its location near ports from which its annual crop of 1–2,000,000 barrels of apples may be exported.

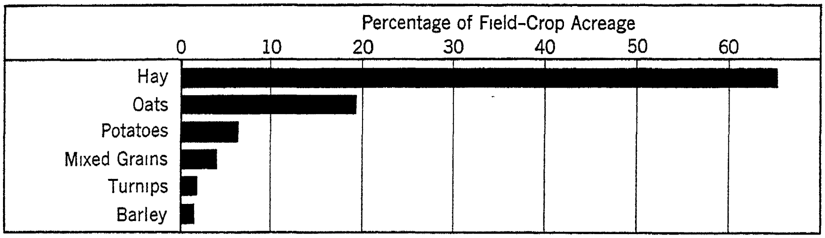


Fig. 229. Use of agricultural land for field crops in Maritime Provinces, exclusive of Newfoundland.

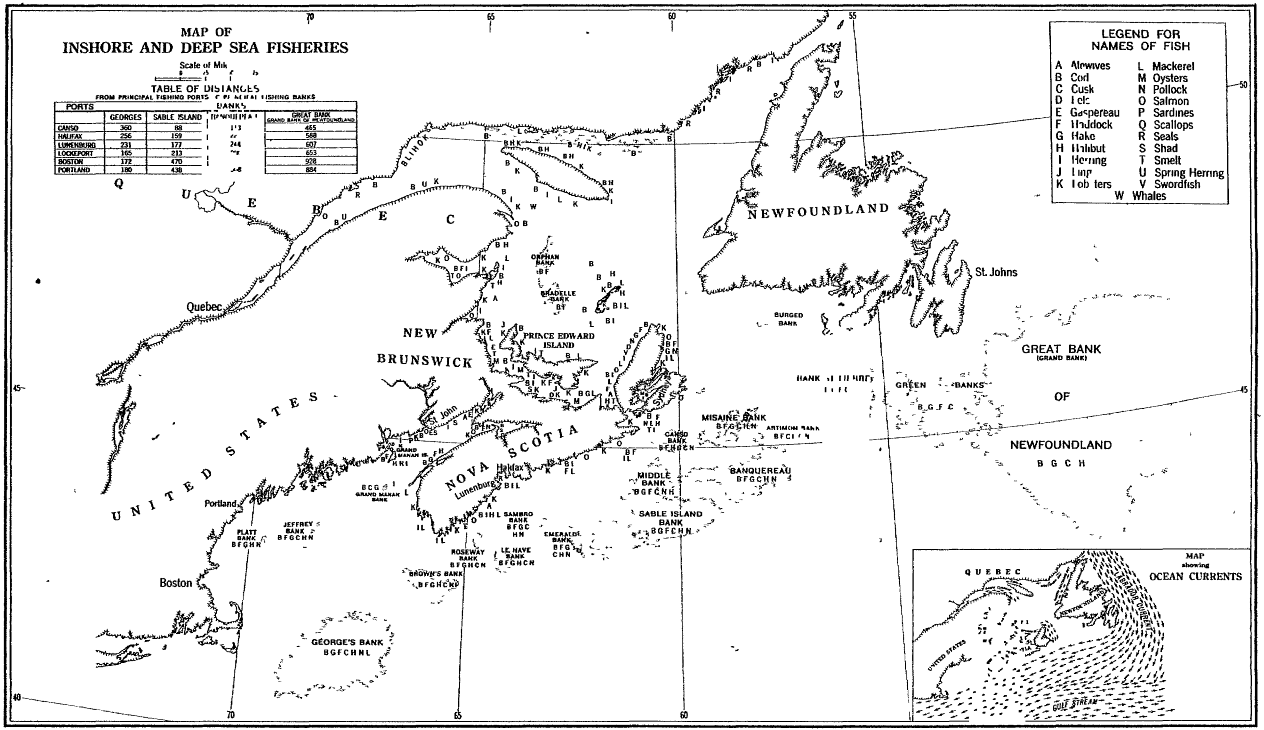
Fur Farming. It is probable that 25 years ago no one in Prince Edward Island expected ever to amass a fortune. However, two enterprising farmers conceived the idea of breeding black silver fox, as the pelts commonly brought prices of $1000–$2000 each. The fur of the domesticated animal was more valuable than that of the wild as it was taken when prime and was uninjured. The industry proved so successful that the value of the animals for breeding purposes soon far exceeded the value of the pelts. High prices led to a rapid expansion of the industry and the production of breeding animals. Fur farming also met with success in Nova Scotia and New Brunswick, and for many years the Maritime Provinces held a leading position in the industry. However, the possibilities of fur farming having been demonstrated, the industry spread rapidly to all parts of Canada, and Ontario and Alberta now occupy the leading position. The fox has proved to be one of the best animals for domestic production, and there are now nearly 100,000 on Canadian fur farms. However, the value of mink is greater than the combined value of all other animals on fur farms of Canada. Other important animals include chinchilla, fisher, and marten. Such has been the rapid growth of a comparatively new industry, which is capable of great expansion. See Table XIX.

TABLE XIX

Fur Farming in the Maritime Provinces and Canada

	Fur Farms		Fur-Bearing Animals	
	Number	Value of Land and Buildings	Value	Percentage of Total Value
Prince Edward Island	503	614,030	574,222	3.5
Nova Scotia	350	249,293	421,333	2.5
New Brunswick	383	274,915	467,125	2.8
Quebec	1,768	1,751,435	2,595,564	15.8
Ontario	1,348	2,490,908	4,318,112	26.4
Manitoba	638	2,021,523	2,367,444	14.4
Saskatchewan	467	935,260	1,357,211	8.3
Alberta	1,027	2,383,295	3,049,500	18.6
British Columbia	313	831,831	1,184,776	7.2
Total	6,797	11,552,490	16,335,287	99.5

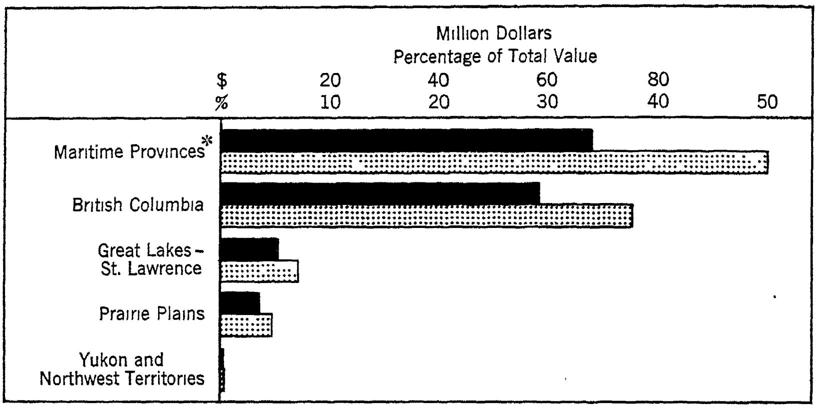
Fisheries. The Atlantic fisheries of Canada are a historic industry. Breton and Basque fishermen frequented the "banks," especially the Grand Banks, in small vessels, as early as 1502, catching fish by hook and line and marketing them in France. When it was discovered that fish were as plentiful inshore as on the outer banks, huts were built on the shore, and fish were salted and dried and taken to France at the end of the season. Later, permanent fishing villages were established, and these became the bases of operations. The natural conditions that have fostered these fisheries since they were first initiated by Europeans are exceptionally favorable. From southwestern New Brunswick to Labrador extends a fishing coast of some 5000 miles. Including the Bay of Fundy



PORTS	GEORGES	SABLE ISLAND	BANQUEREAU	GREAT BANK GRAND BANK OF NEWFOUNDLAND
CANSO	360	88	1?3	465
HALIFAX	256	159	[illegible]	588
LUNENBURG	231	177	244	607
LOCKEPORT	165	213	[illegible]	653
BOSTON	172	470		928
PORTLAND	180	438	[illegible]	884

Fig. 230. The fishing banks in proximity to the Maritime Provinces are among the best in the world. Both deep-sea and inshore fisheries are carried on, but deep-sea is the more important. *After map by National Resources Intelligence Service.*

and the St. Lawrence Gulf, the Maritime Provinces have about 215,000 square miles of fishing grounds, or more than four-fifths of the area of the fishing grounds of the North Atlantic. The long shore line, numerous harbors, relatively shallow and cool offshore waters, and the presence of abundant fish food provide one of the world's best fishing grounds. Here are feeding and spawning grounds of such valuable food fish as the cod, herring, lobster, halibut, mackerel, and haddock. The first three rank next to salmon among the fish produced in Canada (Fig. 263). The lobster fisheries are said to be without a peer. Government assistance in conservation and protection, maintenance of hatcheries, awarding of bounties, and aid in marketing has been an important factor in developing the fisheries. For generations the scarcity of soil and the bleak climate of much of the coastal lands discouraged agriculture and caused people to turn to the sea as a source of livelihood, as available resources of the sea were plentiful. However, with the introduction of the large steam trawler and motor, the movement has been checked and the number of persons engaged in the fisheries has remained essentially static while the investment in equipment has more than quadrupled.



* Includes Newfoundland exports only

Fig. 231. Fisheries of Canada by regions.

The Maritime Provinces bear a relation to the world's supply of fish similar to the relation of the Prairie Plains region to the supply of wheat. More than half the total value of the Dominion's fisheries comes from these Provinces, Nova Scotia and Newfoundland leading with more than three-fourths of the total for the region (Fig. 231). The inshore fisheries, which are carried on within 10-12 miles of the coast, are more important than those of the deep sea. They are safer, entail less hardship, require less equipment, and are more profitable, as a large part of the catch is shipped fresh each day to Quebec, Ontario, and the New England States. The deep-sea fisherman requires larger and more expensive equipment and may be out for several weeks or even months, and must pack and salt the fish on board ship. Lunenburg is the chief center in Nova Scotia for the fishing fleets, although nearly every village along the coast has its fishing vessels, drying sheds, and canneries (Figs. 232 and 233). Most of the cured fish goes to the West Indies, South America, and European countries, especially Spain.

Fig. 232. Part of the harbor of the fishing village of Lunenberg. *Photo by Miller.* This is the leading fishing center of Nova Scotia. A large fish flake is shown in the center. The docks and warehouses are in the background. The fishing fleet was "out" when this picture was taken.

Forests. The forests have long been a heavy contributor to the wealth and revenue of the region, and with the application of modern methods of conservation may remain so indefinitely. They are similar to those of New England, red spruce being the characteristic tree. Others of commercial value include white spruce, balsam fir, white pine, hemlock, yel-

TABLE XX *

Production of Forest Products of Maritime Provinces

	Sawmill Products		Pulp and Paper	
	Value	Percentage	Value	Percentage
New Brunswick	14,640,600	49.5	35,684,000	42.3
Nova Scotia	11,395,200	38.5	5,838,600	6.9
Newfoundland (estimated)	3,100,000	10.5	42,700,000	50.6
Prince Edward Island	407,800	1.3	—	—
Total	29,543,600	99.8	84,222,600	99.8

* Compiled from *Canada Yearbook.*

low birch, maple, beech, and cedar. Many billions of feet of timber are available for exploitation. Estimates give New Brunswick a forest resource of 9,000,000,000 board feet of saw timber and some 80,000,000 cords of pulpwood, and for Nova Scotia 6,450,000,000 and 29,105,000, respectively. It is estimated that Newfoundland, exclusive of Labrador, has approximately 38,550,000 cords suitable for pulp. Exploitation of forest resources is carried on most extensively in New Brunswick, where the annual income from forest products exceeds the gross agricultural revenue. Measured in value, this province alone produces about half the sawmill products of the region. However Newfoundland produces half the pulp and paper (Table XX).

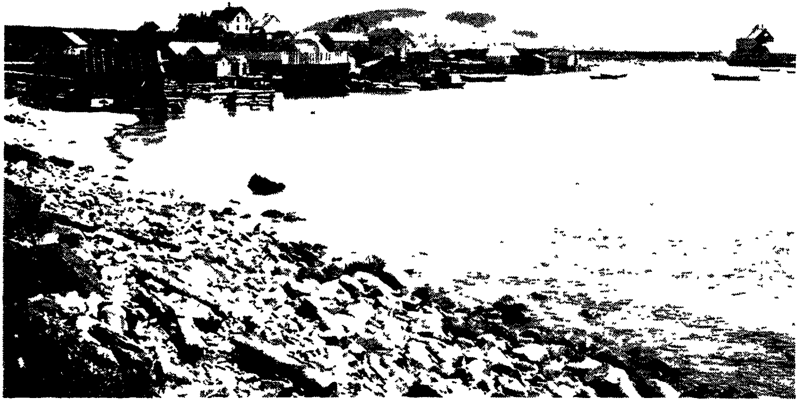


Fig. 233. A small fishing village on the Atlantic coast of Cape Breton Island. *Photo by Miller.* The life of the community is tied closely to the sea.

Mining (Fig. 234). Compared with New England, the Maritime Provinces are rich in mineral resources, but they appear poverty stricken in comparison with the resources and mineral production of the Middle Atlantic States. A few resources may be of great significance in a small area, and this may be so in the future of Nova Scotia and New Brunswick. Large deposits of coal of high quality occur accessible to tidewater, and are likely to be of increasing importance. Except for the small deposits of anthracite in Rhode Island, the coal deposits of the Maritime Provinces are the only ones on the Atlantic seaboard of North America. The rich Sydney fields now produce about three-fourths of the annual output of Nova Scotia. With more than 1,300,000 tons of hematite iron ore from Newfoundland annually brought only 400 miles by boat, with abundant coal suitable for blast-furnace coke, gas, and steam, with good harbors such as Sydney, Louisburg, and New Glasgow for shipment up the St.

Lawrence to the coalless and ironless sections of Quebec and Ontario, or to other parts of the world, Cape Breton Island and Pictou County of Nova Scotia should become very important coal-producing, and iron- and steel-manufacturing centers. If more ore is needed in the future, the Labrador[1] deposits may be drawn upon. The iron and steel industry of Nova Scotia is now one of the most important in Canada. Coal is the only non-metallic mineral of outstanding importance produced at the present time. It constitutes over 85 per cent of the total value of Nova Scotia's mineral production and 43 per cent of that of New Brunswick. Together, these provinces produce two-fifths of the annual output of Canada. Gypsum ranks second in value. As with coal, the deposits are at or near tidewater and are capable of extensive development. Most of the gypsum produced is marketed in the United States. Much of it is resold to the Canadians in the form of plaster. Among other minerals of present or of potential economic significance should be mentioned gold, salt, manganese, limestone, and excellent clay.

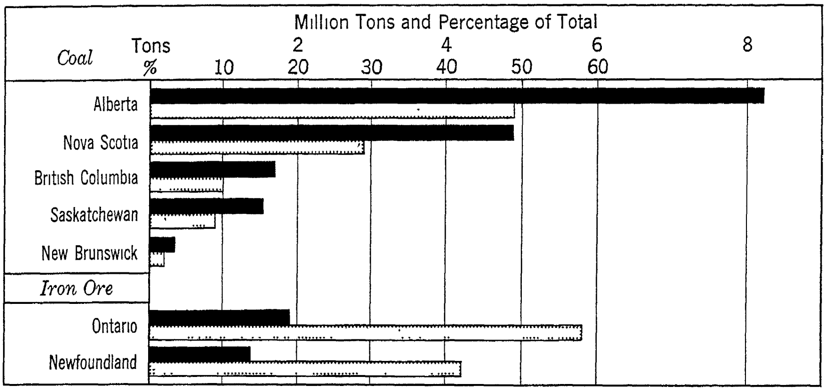


Fig. 234. Coal and iron-ore production of Canada by provinces. Three-year average.

Manufactures. Manufacturing in the Maritime Provinces is based directly upon the utilization of the local natural resources—agricultural, forest, fishery, and mineral—and has become the chief source of income. Manufacturing is more fully developed in Nova Scotia than in any other province; New Brunswick is second. Shipbuilding, iron and steel, and fishery products lead in Nova Scotia, whose two leading enterprises are the outgrowth of the utilization of the local coal and the iron ore from Newfoundland. In New Brunswick the forest industries—pulp and paper, sawmill products—are nearly five times greater than the third industry, which is the curing and packing of fish. Fishery products, butter and cheese, fruit and vegetable products lead on Prince Edward Island, and the pulp and paper industry is the only one of importance in Newfoundland.

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[1] Along the Quebec border. Further, Ungava deposits may become available.

CITIES

Urban population has been growing at the expense of rural. This tendency has become pronounced, especially in Nova Scotia, where the rural and urban populations are nearly alike. This movement is in keeping with the industrial development. However, nearly two-thirds of the population of New Brunswick and three-fourths of that of Prince Edward Island are classed as rural. All the more important cities have developed on harbors.

Halifax-Dartmouth is the leading center and gives employment to the largest number of people in its industries. Halifax expects to become one of the great Atlantic ports. It is the terminal of the Canadian National Railways, with extensive improvements to make it a great ocean port; it has an ice-free, siltless outer harbor 1 mile square and 70 feet deep, an inner harbor of 10 square miles with a 45-foot depth at the piers at low water, and average tidal range of 4 feet, free from troublesome currents; it is protected at the entrance by islands; it is on the main trade route between western Europe and the northeastern United States; and it is 616 miles nearer Liverpool than New York is (Table XXI). It is now the leading port of the Maritime Provinces, though Saint John is a close second, and its registered tonnage is larger than that of Quebec and nearly three-fifths that of Montreal. Like Saint John it is of special importance to Canada as a winter port when the St. Lawrence is closed by ice. Large quantities of grain, lumber, dairy products, woodpulp, fish, and fish

TABLE XXI

Comparative Table of Distances from Halifax and New York to Six Trade Centers

To	Miles from Halifax	Miles from New York
Liverpool	2450	3100
Pernambuco	3451	3678
Rio de Janeiro	4611	4748
Montevideo	5586	5723
Buenos Aires	5701	5838
Cape Town	6423	6786

products are exported; raw sugar, coffee, tea, crude oil, machinery, textiles and many other manufactures are imported. Halifax and Saint John now handle nearly a third of Canada's Atlantic shipping.

Saint John is the second city in size and in number of people engaged in manufacturing industries. It is the focal point of New Brunswick, and particularly of the fertile and productive valley of the Saint John River; it is the eastern terminal and winter port of the Canadian Pacific Railway and is nearer Montreal than Halifax is, though farther from Liverpool by 200 miles. It possesses a good harbor, kept ice-free by the large tidal range which gives a depth of 32 feet at low tide and 58 feet at high tide. The character of the commerce is very similar to that of Halifax.

At the north on Cape Breton Island is Sydney industrial district, located in the rich coal fields, and the center of the iron and steel industry. It has 15 square miles of harbor 40 feet deep, with 30 feet at the piers. Fogs are rare, but under unfavorable wind conditions ice blocks the entrance at times for 2 months. These three urban centers dominate the manufacturing and commercial life of the region.

NEWFOUNDLAND AND LABRADOR

Location and Surface. The development of transoceanic aviation and World War II have emphasized the locational significance of Newfoundland—it is only about 2360 airline miles from Gander airport to London. Blocking the entrance to the Gulf of St. Lawrence except for narrow passages 60 miles wide on the south and 10–15 on the north, its high, rocky, and deeply indented coast appears barren and forbidding when approached from the sea (Fig. 235*A*). Less than a mile inland it is still a primitive wilderness. In the unsettled interior are stretches of fertile soil, and along its streams and numerous lakes are excellent forests. Structurally and economically it is a part of the Maritime Provinces. Geologically it is a part of Greater Acadia, and is essentially a plateau having a gently rolling surface, rising from east to west from about 700 feet in Avalon Peninsula to about 2000 feet in the Long Range Mountains. Its surface is cut by a number of river valley lowlands that break the island structure into belts trending northeast-southwest. During glacial times the whole area was covered and uplands were scraped to bedrock. The loose soil and other rock materials were carried out to sea or deposited in the valleys. Labrador is a part of the Canadian Shield. The plateau character of the south and southeast gives way to mountain ranges in the north.

Climate. The marine climate of Nowfoundland is affected greatly by the surrounding cold waters and eastward movement of air masses from the continent. The Labrador Current embraces the island with cold waters laden with pack ice in winter, and icebergs from Greenland in the summer. Fogs frequently enshroud its coast, as the warm waters of the Gulf Stream Drift mingle with the cold waters of the Labrador Current. The fog, however, does not extend far inland. Winters are cold and long and summers short and cool. Precipitation is abundant and well distributed over the island and throughout the year. Heavy snowfalls at the north decrease in amount toward the south. The climate of interior Labrador is arctic in character, with very low winter temperatures. Even though the coast is washed by cold waters the winters are much milder

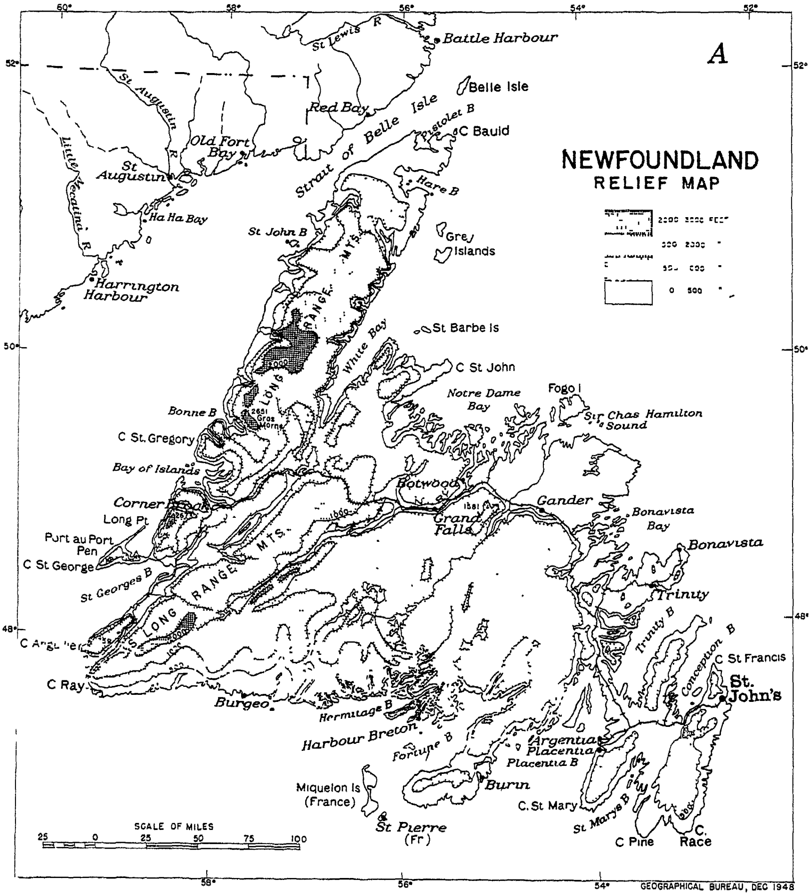


Fig. 235*A*. Newfoundland relief map. *Geographic Bureau*, 1948.

than those of the interior. Summers are cool to cold with moderate precipitation.

Soil and Vegetation. Much of the plateau area is covered by a thin layer of glacial gravels. Podzols prevail over nearly all Newfoundland and may be classed generally as unfertile. However, good agricultural soils are found in restricted areas such as those of the west coast and in several river valleys. Neither climate nor soils encourage utilization of the land for crop production.

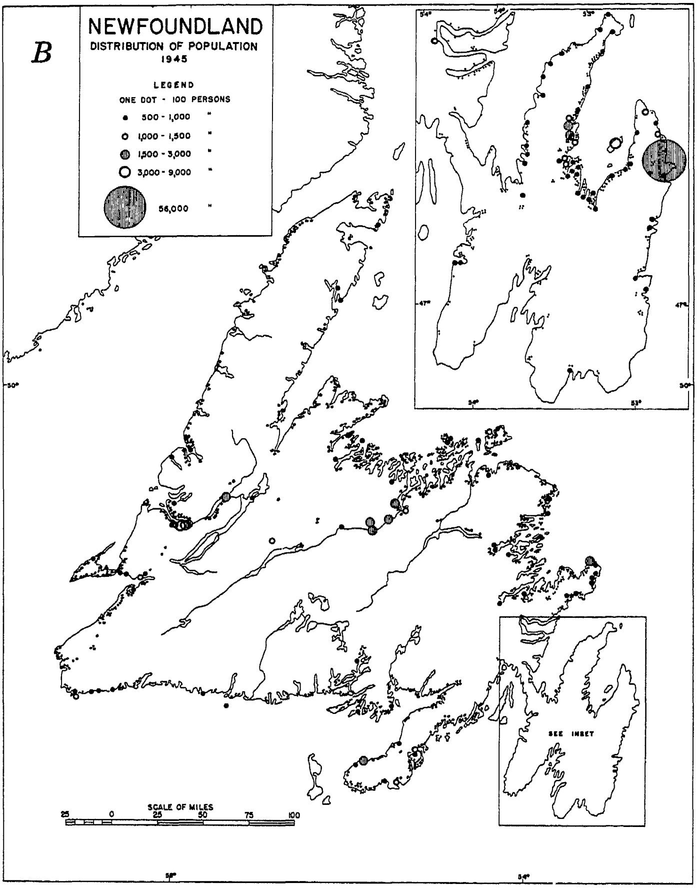


Fig. 235*B* Distribution of population, Newfoundland, 1945. *Geographical Bureau,* 1948.

The long, cold winter and cool, humid summer favor the growth of coniferous rather than deciduous forests, though mixed forests occur. A little less than half (47 per cent) the land area of the island is forest covered. The better forest areas are located on the valley slopes of the principal rivers such as the Gander, Humber, Terra Nova, and Exploits. The more valuable trees consist of balsam fir, white spruce, black spruce, yellow birch, and white pine. The plateau areas are largely barren of trees but have extensive bogs, and also tundra at the higher elevations. The forests of southern Labrador and those of Newfoundland are essentially alike, and the tundra of the north and coastal area corresponds to that of the higher plateau areas of Newfoundland.

UTILIZATION OF NATURAL RESOURCES

There are only about 320,000 people in Newfoundland and 5500 in Labrador (Fig. 235*B*). More than nine-tenths of these are in scattered communities along the coast. The only towns in the interior are along the railway where forest and mining industries are located. The greatest concentration is in Avalon, which has about 45 per cent of the total population of Newfoundland. Greater Saint John's is located here and has a population of about 57,000. Both Newfoundland and Labrador are still in a very primitive stage of industrial development. Economy is based primarily on fishing, forestry, and mining. Fishing was the only industry of importance for 400 years. It is only comparatively recently that forests and minerals have been utilized.

Agriculture. Both climate and soil are adverse to agriculture, and it is of minor importance. It is primarily of the subsistance type, with very few farmsteads of more than 50 acres. Major areas of commercial farming are in Avalon Peninsula and in the lower Humber valley of the southwest, near the larger consuming centers. More than half the acreage is devoted to hay and pasture. Agriculture is primarily a hay, dairy, and root-crop economy, with potatoes the main crop. Dairying leads on the west coast and in Avalon where milk products find a ready market.

Forestry. Forests rank next to fisheries as the leading source of employment and income. Although there are some 900 sawmills employing 3000 men on the west and east coasts, the great bulk of the timber is used in the pulp and paper industry. This is the most important industry that has developed in Newfoundland in centuries, giving employment to nearly 7000 men. Newfoundland possesses excellent advantages for the development of this industry. The timber is cheap and excellent for pulp, is near good harbors free from ice on the south coast, and occurs in dense stands; the rivers are suitable for conveying logs to the mills and for hydroelectric power (Fig. 235*C*); Newfoundland is much nearer the markets of Europe than is the United States or other parts of Canada; and there is an abundance of labor, especially during the off-season for fishing. Estimates indicate that, with reasonable fire protection, the forest resources will last indefinitely since cut-over land reforests rapidly, and the forests of Labrador are untouched.

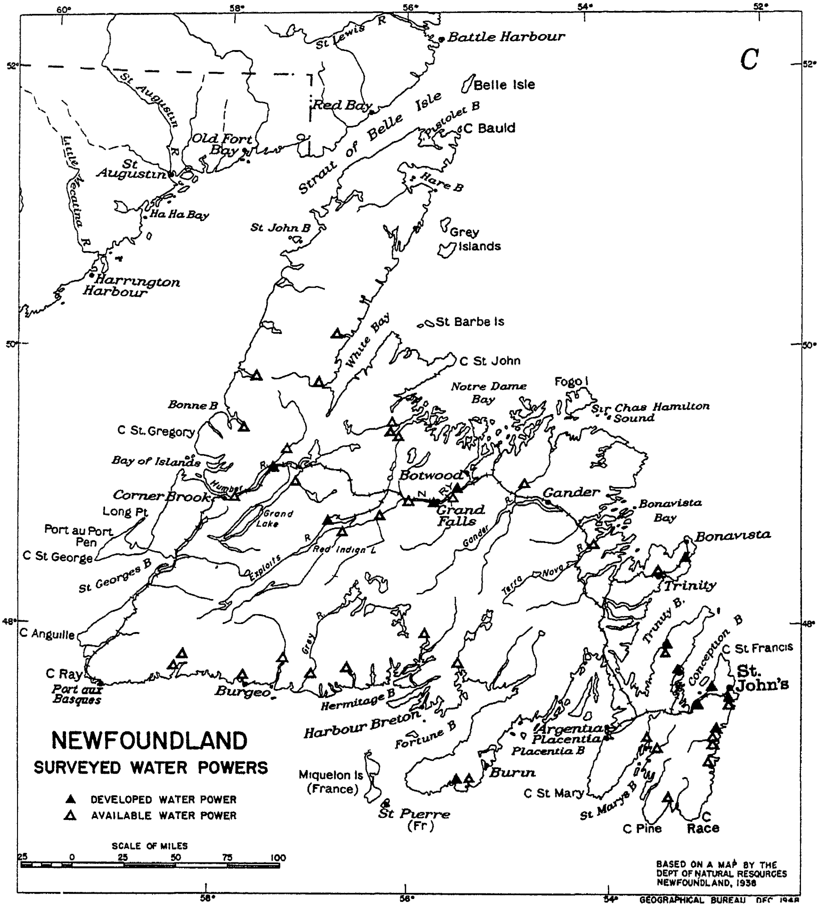


Fig. 235*C*. Surveyed water powers of Newfoundland. *Geographical Bureau,* 1948.

Minerals. Minerals (Fig. 235*D*) are known to occur in considerable variety, quantity, and quality, including iron, coal, lead, zinc, silver, chromite, nickel-copper, and asbestos. Thus far the mining industry has been wholly extractive for export. Coal mining has not been developed, and there is no smelting industry. The Wabana iron ores of Bell Island in Conception Bay are Newfoundland's largest mineral asset, and one of the world's greatest deposits. Estimates of probable reserves vary from 2,500,000,000 to 10,000,000,000 tons of hematite ore. Mining is confined to the northwest side of the island, and operations extend 2¼ miles beneath Conception Bay. Production runs about 1,300,000 tons annually, more than half of which goes to the steel mills at Sydney, Nova Scotia. Other exports are chiefly to Great Britain. Among the other leading metallic minerals are zinc, lead, and copper, about 120,000 tons of concentrates being produced annually.

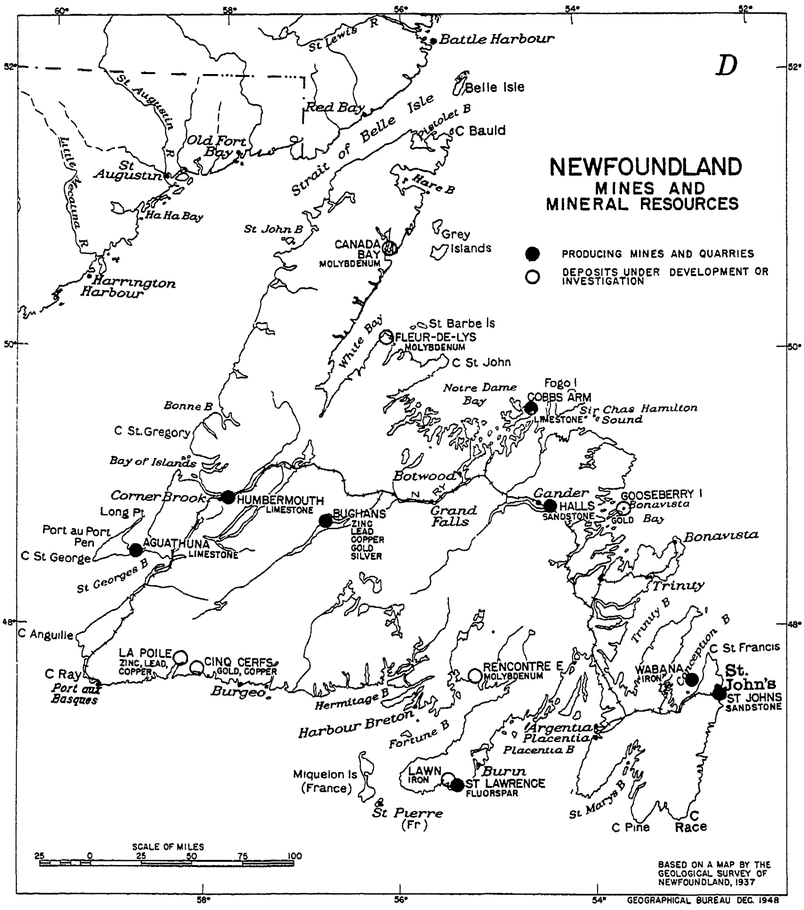


Fig. 235*D*. Mine and mineral resources, Newfoundland. *Geographical Bureau,* 1948.

Huge deposits of high-grade iron ore occur along the Labrador-Quebec boundary. No attempt has yet been made to estimate the probable reserves. However, sufficient deposits have been blocked out to warrant development. These ores will be brought by rail to the St. Lawrence for shipment. An abundance of water power of at least 1,200,000 hp is available for mining operations. With the decline of high-grade resources in the United States, and completion of the St. Lawrence Seaway, the United States may become the chief market for these ores.

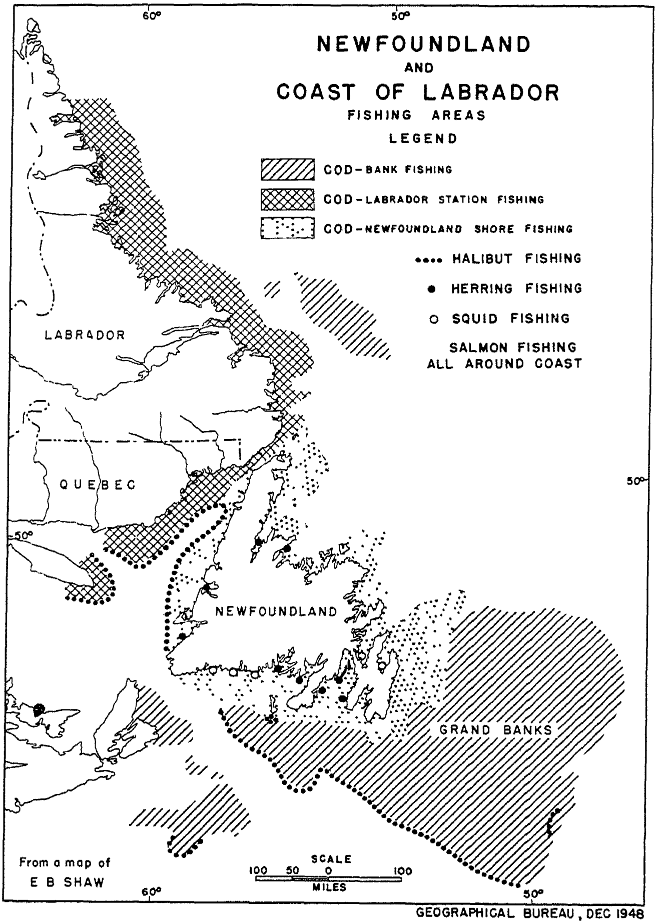


Fig. 236. Fishing areas, Newfoundland and coast of Labrador. *Geographical Bureau,* 1948. *From a map by E. B. Shaw.*

Fisheries, the Dominant Industry. The cool and shallow waters of the Grand Banks, which lie 100 miles off the southeast shore, are one of the world's finest fishing grounds. Sunlight penetrates the cool, shallow waters, favoring the growth of plankton, upon which herring, caplin, and squid feed. These fish constitute a large part of the food of cod, for which the Banks are noted (Fig. 236). In addition to the cod fisheries of the Banks, and those nearer shore, thousands of fishermen journey to the fishing banks along the coast of Labrador during the summer. About the middle of March each year, the sealing fleet sets out from Saint John's to the sealing grounds along the north shores. Here on the ice floes, the hair seal gives birth to its young. Only the bachelor seals are killed, but the annual catch is declining. The hair seal is not the same as the fur seal. Its skin is used for the manufacture of fine leather goods, such as belts, bags, and cigar and cigarette cases. The oil extracted finds a market as illuminant, for the manufacture of margarine and soap, and medicinally as a cod-liver oil substitute. The cod is by far the most important product of the sea. It accounts for four-fifths of the total value of all fishing products, nearly all of which are exported. The principal markets are Brazil, Spain, Portugal, Italy, and West Indies.

Fishing is well-nigh the sole interest of the coastal people of both Newfoundland and Labrador. This is to be expected since the land is poor and inhospitable, and the off-shore waters, countless bays, and open sea teem with fish. The people have little interest in agriculture. Fishing has been the dominant interest of Newfoundland's people for centuries. Its economic life throughout its history has been based upon the fisheries of the Grand Banks and along its shores. The people think in terms of cod, herring, halibut, lobster, and seal. Fully 40 per cent of the people employed in gainful occupations are in the fisheries, and probably half the total population is dependent on the industry.

For many years the annual value of the fisheries led all other products, its relative position depending upon the export market for fish, especially dried and salted cod. Now the pulp and paper industry ranks second, supplying about 40 per cent of the value of exports. More than two-thirds of Newfoundland's exports of all kinds of domestic produce find a market in the United States and Great Britain, and it buys nine-tenths of its imports from Canada and United States.

PROBLEMS

1. Will the future growth of commerce, industry, wealth, and population in the Maritime Provinces give them a leadership in Canada comparable to the leadership now held by the North Atlantic States in the United States?
2. The Maritime Provinces possess opportunities greater than those of New England for commercial and industrial development.
3. Will Halifax and Saint John become the leading ports of eastern Canada?
4. It is more than three centuries since the first English settlement was made in Newfoundland. Has Newfoundland reached the highest stage of industrial development that may be expected?

5 Would reciprocity with the United States produce a development of the Maritime Provinces comparable to that of New England?

6. Can the Maritime Provinces maintain a population greater than that of the Pacific Mountain Region?

7 What will be the two leading industries of the Maritime Provinces?

8. Will the proposed Great Lakes-St. Lawrence Seaway benefit or injure the Maritime Provinces?

CHAPTER 22

The Great Lakes-St. Lawrence Region

Politically this region includes the Provinces of Quebec and Ontario, but most of the vast area is primeval wilderness unprospected except along the major streams. From the standpoint of human occupancy the region is limited to the Great Lakes-St. Lawrence Lowland, including the triangular section of Ontario east of Lake Huron—Peninsular Ontario—a few shipping centers on Lake Superior, and a few mining or forest industry communities on the Canadian Shield. It is this comparatively small part of the region with which we are primarily concerned. Much of the economic development has been and still is associated closely with the St. Lawrence River and the Great Lakes, as the sparsely populated Shield occupies fully two-thirds of Ontario and nine-tenths of Quebec. The Lowland section, where most of the people live and where most of the development has taken place, is isolated from western Canada by hundreds of miles of rocky, lake- and swamp-studded, forested land of very low productivity. One of the large problems of Canada is to bridge this natural barrier.

Canadian Shield Section. The southern portion of the Canadian Shield is tributary to the Great Lakes-St. Lawrence Lowland. Its general characteristics are described earlier in the book. As a result of its geological history, it has a great variety of metallic minerals, most notable of which are nickel, copper, gold, uranium, and silver. Glaciation left much of its surface without soil, and hence sterile, though here and there are drift-filled valleys and small patches of glacial till. However, these soil areas are commonly located in poorly drained country and are difficult of access, hence of limited crop value. The most striking exception is the "Clay Belt" south of James Bay. It was expected that completion of a railroad across the Clay Belt to Moosonee would hasten its agricultural development. Glaciation also accounts for the vast number of lakes and muskegs that serve as reservoirs to regulate the stream flow, likewise for many of the falls and rapids that provide large water-power resources. Trees thrive in the soil areas or where the rocks are broken sufficiently for the roots to gain hold. In general the southern portion is densely forested with valuable timber. Forests, minerals, and water power constitute the principal resources now utilized by man. Only a relatively small number of people actually live in the Canadian Shield portion of the region. Its water power, its minerals, its forests, its furs, and its other assets are tributary to the industrial centers of the Lowland. The labor of reclaiming its scattered and commonly isolated soil areas, and its large proportion of barren rock and boulder-strewn land make it less desirable to the prospective home builder than the fertile western prairie where transportation facilities and markets are already available.

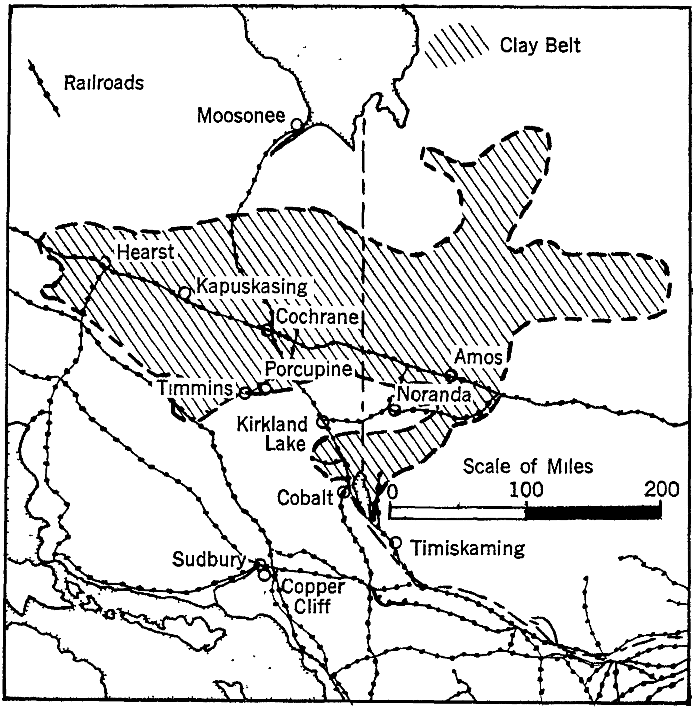


Fig. 237. The Clay Belt of Ontario.

The Clay Belt. This region has gained prominence largely because of the efforts of both Quebec and Ontario to extend their agricultural area by promoting its development (Fig. 237). Though numerous small soil areas occur in the Shield, the major Clay Belt occupies some 40,000 square miles about 50 miles south of James Bay. It is roughly 450 miles long east and west and 50 to 150 miles wide north and south. Most of the area is the forest-covered bed of glacial Lake Ojibway, and the soils are peaty lacustrine clays, changing, in the northern section, to peaty glacial clays. The forest cover is chiefly black spruce and balsam suitable for pulpwood.

Its climate is the subarctic type, with an abundance of precipitation. Kapuskasing may be taken as typical of the central portion of the area, where the mean annual precipitation is 27 inches, and July and January mean temperatures are 62.4° and -1.7°, respectively. Late, cool rains in August and September are a serious handicap to ripening and drying grain and hay crops. The growing season is highly variable. Cold air drains into the lowlands, and the growing season may be only 35 to 45 days. On the shores of Lake Timiskaming, on the southern margin, the frost-free period averages 123 days. Perhaps 80 to 85 days is a fair average for the region as a whole. However, frosts may occur during any summer month, making agriculture hazardous.

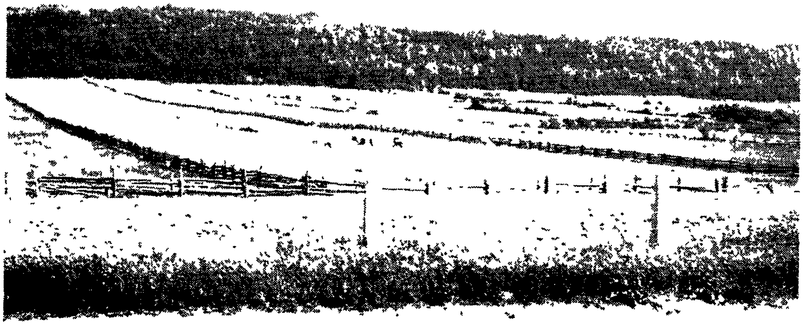


Fig. 238. Typical long and narrow fields in the St. Lawrence Lowland of Quebec. *Photo by Miller.*

The poorly drained podzolic, peat-covered clay soils are difficult to put into good condition for cultivation and crop production. The peat cover ranges from 6 inches to 4 feet. The thicker layers must be removed by burning, and some are mixed with the clay for cultivation. The major crops are hay and oats for cattle feed. Vegetables and root crops are produced mainly in garden plots.

The most successful agricultural development is in the Timiskaming section, extending northward to Cochrane. As a whole the Clay Belt is still on the pioneer fringe. Fortunately the settler may clear his land and sell the timber as pulpwood at paper-mill centers such as Kapuskasing. The pulp and paper mills, and mining and smelting centers, such as Timmins, Noranda, Kirkland Lake, Cobalt, and Sudbury, also provide a market and part-time work for the pioneer farmer. Since the area is crossed by two railroads—Canadian National and Ontario Northland—transportation is available though the costs are high. It seems probable that occupancy of the area will proceed very slowly and success will depend upon maintenance of mining and forest industries, particularly pulp and paper.

The Lowland. The Great Lakes-St. Lawrence Lowland extends from Lake Huron through Quebec and is divided into two major sections by an extension of the Shield which crosses the St. Lawrence between Kingston and Brockville. The surface is largely drift-covered sedimentaries and affords a great variety of fertile soils, in contrast with the hard granitic rocks of the Shield at the north. All parts have a climate suitable to the growth of cereals and temperate fruits. Since the Lowland extends some 600 miles from east to west and 300 miles north and south, and the western lake peninsula is nearly surrounded by water, there is also variety in climate. Crops such as wheat and corn will thrive best in the more southerly lake peninsula, and oats and barley at the north. This combination of fertile soils and favorable climate makes agriculture one of the greatest permanent industries of the region, if not the greatest. The agricultural opportunities and natural means of communication afforded by the Great Lakes and St. Lawrence led to the relatively early settling of these lowlands. The St. Lawrence and the Great Lakes are still among the region's greatest assets, and exercise a profound influence in the development of the region.

TABLE XXII

COMPARATIVE POSITION IN THE DOMINION OF THE GREAT LAKES-ST. LAWRENCE REGION

1. 61.8 per cent of the population.
2. 71.1 per cent of the urban population.
3. 64.2 per cent of all cities of 5000 or more.
4. 31.8 per cent of potential agricultural land.
5. 23.8 per cent of the average acreage of field crops.
6. 33.4 per cent of the average gross agricultural revenue.
7. 65.2 per cent of the value of dairy products.
8. 75.3 per cent of the annual production of wood-pulp.
9. 81.4 per cent of the net value of manufactures.
10 81.3 per cent of the manufacturing employees (average).
11. 55.2 per cent of the export trade, net weight.
12. 84.0 per cent of imports, net weight.
13. 54.1 per cent of the mineral production by value.
14. 82.2 per cent of installed water power.

Its mineral resources are comparatively small, and it is without coal. However, the many streams that come tumbling from uplands of the Shield compensate for the absence of mineral fuels, as they provide a superabundance of power conveniently located. Fertile soils, favorable climate, good natural transportation facilities giving access to the open ocean, and vast tributary forest, mineral, and power resources have made this the most desirable region of Canada (Table XXII). Here is more than three-fifths of the population of the Dominion. Measured in terms of population, manufacturing, commerce, large cities, total wealth, educational institutions, or influence in national affairs, the Great Lakes-St. Lawrence Lowland is essentially Canada.

AGRICULTURE

Agricutural Area. Agriculture is confined almost exclusively to the gently rolling glacial drift and alluvial soils of the lake peninsula and the lower St. Lawrence Valley. The peninsular section presents an agricultural landscape similar in many respects to that of northern Ohio and Indiana. However, as one approaches its northern border, along the Canadian Shield escarpment, conditions typical of a frontier settlement appear. Here the "bush" becomes dense, and scattered clearings of pioneer farmers dot the area. In the eastern, or Quebec, section the occupied area is almost wholly south of the St. Lawrence, the eastern townships constituting the most important section. This is a hilly agricultural and mining district. North of the river human occupancy is based on the forest industries—lumber, pulp, and paper. A striking feature in the agricultural landscape of the St. Lawrence Lowland is the long, narrow fields that stretch away from a line of transportation, such as the St. Lawrence or a highway (Fig. 238). Agricultural methods and rural living conditions are primitive compared to the central section of the United States or the southern portion of Peninsular Ontario. Outdoor bake ovens, and open wells with a long, weighted pole sweep to lift the water are common. However, change is now taking place, and it appears likely that at least some of the quaintness of old Quebec is passing.

The humid, continental type of climate favors the production of hay and forage, pasture, and oats. The opening of the cheap and fertile lands of the Prairie Plains and the migration of grain growing thereto made competition in the Lowland extremely difficult. These conditions, coupled with good home markets, led to the development of mixed farming and dairying, and especially the production of butter and cheese. Only in the more southerly section of the lake peninsula do corn and swine raising approximate ~~the~~ production to the square mile of Iowa.

Where lake and marine influences moderate the climate, fruits are grown for market. Noted apple regions are in the Montreal district south of Georgian Bay; and along the northern shores of Lakes Erie and Ontario; the Niagara peninsula also produces the less hardy strawberries, grapes, and peaches. Though the region has nearly one-third of the potential arable land of the Dominion only about one-sixth is now utilized for field crops, three-fifths of which is in the western or Ontario section. The region therefore has the potential agricultural resources which, combined with the denser population and accessibility to good domestic and foreign markets, should enable its people to maintain their relative agricultural position in competition with other regions.

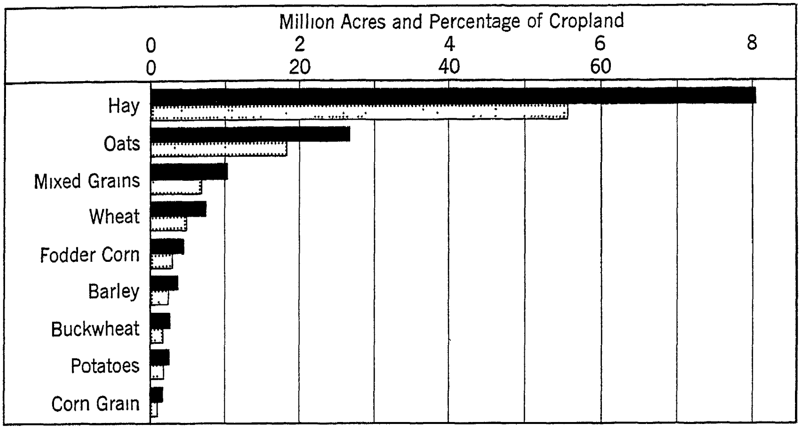


Fig 239 Leading crops of the Great Lakes-St Lawrence Region.

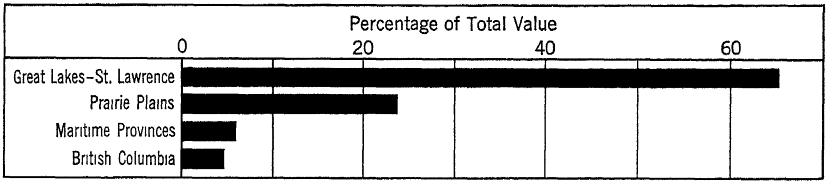


Fig. 240. The dairy industry by regions

Leading Crops (Fig. 239). The Lowland region is dominantly a hay and forage and oats country, as these crops are raised on more than three-fourths of the cultivated land. In the lower St. Lawrence section, nine-tenths of the crop acreage is devoted to these crops, and more than two-thirds to hay and forage alone; and in the Ontario section the proportion is nearly seven-tenths devoted to the two crops and more than half of this to hay and forage. Other crops include mixed grains, wheat, barley, buckwheat, potatoes, and corn. Over nine-tenths of the wheat is grown in the lake peninsula, where it provides a cash crop to this section. The Lowland has long been an important agricultural area, and, even though the open grasslands of the west have developed rapidly, it still produces a third of the total crop value of the Dominion.

Livestock and Dairying. A climate and soil favorable to the production of stock food, accessible markets in the large industrial centers and abroad, and inability to compete with the west in cereals encouraged mixed farming, the raising of livestock, and specialization in the dairy industry. The region has half or more of the cattle and swine of Canada. Dairying (Fig. 240) now occupies a very important place in the agricultural economy of Quebec, where there are more than 1000 butter and cheese factories. Butter is its specialty, and it leads all other provinces in annual production, as Ontario does in cheese. However, the larger area, more favorable climate, soil, and markets have enabled the Ontario section to produce dairy products having a total value in excess of that of Quebec. The two sections of the Great Lakes-St. Lawrence Lowland produce more than half the butter, nine-tenths of the cheese, and two-thirds the value of all dairy products of Canada. In addition it is a very large producer of cattle and swine for slaughtering.

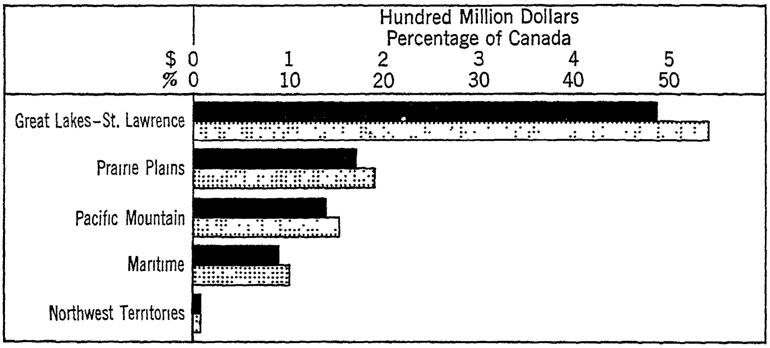


Fig. 241. Relative value of mineral production of Canada by regions. Three-year average.

MINERALS

The Canadian Shield contributes the metallic mineral wealth and the Lowland contributes most of the non-metallics. Nearly all the metallic ore, except iron, is produced in the Sudbury-Kirkland-Lake Noranda-Porcupine Area of Ontario and Quebec (Fig. 237), the annual output of

Ontario being many times that of Quebec. The ores are mined primarily for gold, nickel, and copper but many others are obtained. About three-fourths of the world's supply of nickel comes from the Sudbury mines. Nearly all the nickel-copper ore is reduced in smelters at Copper Cliff and refined at Port Colborne. Metals of the platinum group, recovered in the refining process, are sent to Acton, England, for refining. Some of the matte from the nickel-copper smelters is sent to Kristiansand, Norway, for refining; however, this is probably less than a tenth of the nickel output. The Porcupine and Kirkland Lake areas are the major producers of gold. The concentration of mining, smelting, and pulp and paper-mill communities in this section was one of the major factors in encouraging agricultural development of the Clay Belt. Except for Newfoundland the Shield also yields virtually all of Canada's iron ore. This ore comes from the newly developed mines at Steep Rock about 75 miles north of the Mesabi range of Minnesota and 125 miles west of Port Arthur. Here the ore is obtained from the bed of a drained lake. The ore is high grade, averaging about 60 per cent metal, and is low in phosphorous and silica. With depletion of high-grade ore in the United States, this ore will find a ready market there as well as in Canada. The Lowland produces building materials, asbestos, petroleum, and natural gas. The eastern town-

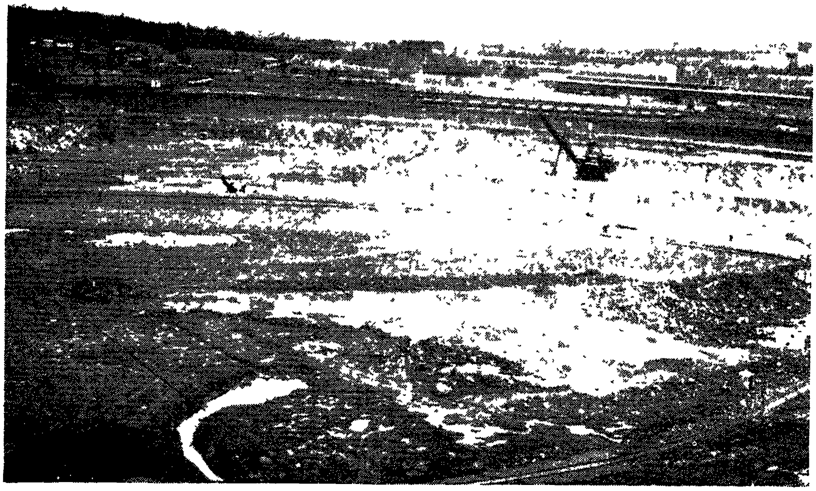
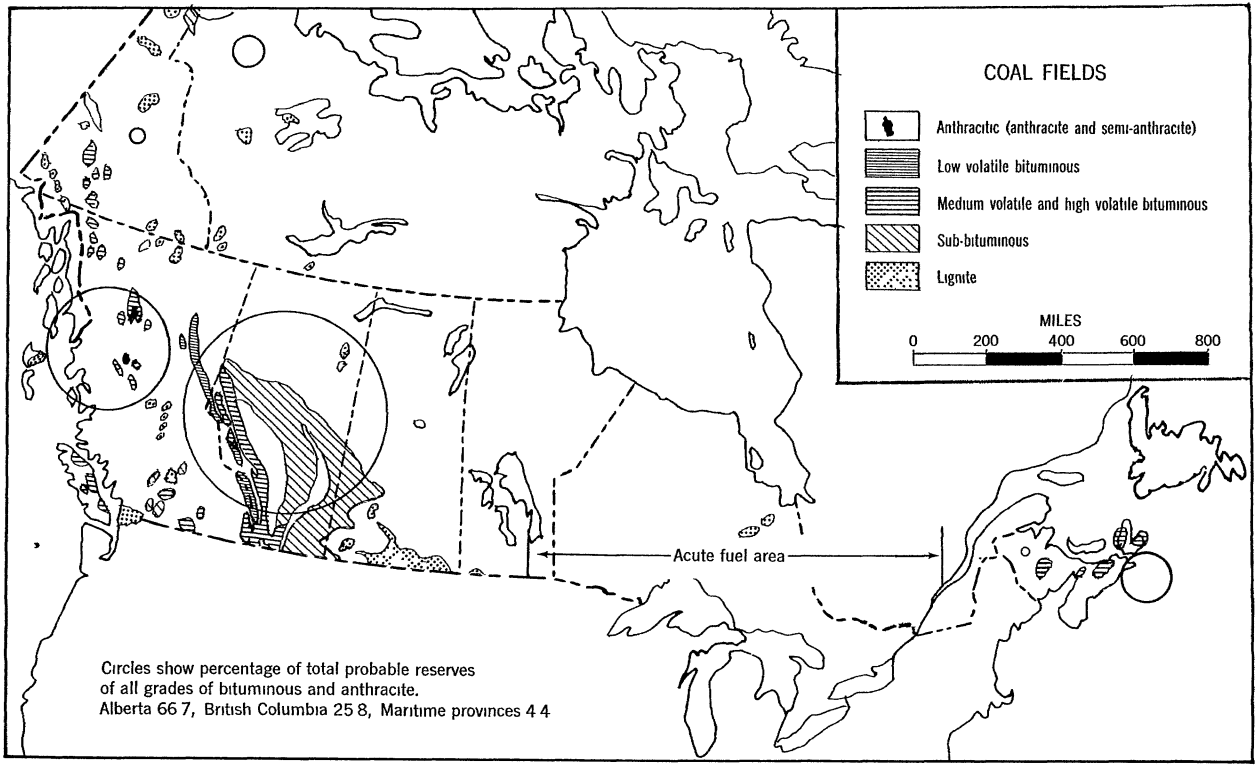


Fig. 242. Part of open-pit asbestos mine in Quebec. The large fabricating plant is in the right background. *Photo by Miller*



COAL FIELDS
Anthracitic (anthracite and semi-anthracite)
Low volatile bituminous
Medium volatile and high volatile bituminous
Sub-bituminous
Lignite
MILES
0
200
400
600
800
Acute fuel area
Circles show percentage of total probable reserves
of all grades of bituminous and anthracite.
Alberta 66 7, British Columbia 25 8, Maritime provinces 4 4

Fig. 243 Distribution of coal resources of Canada. The Great Lakes-St Lawrence Region is seriously handicapped by a lack of coal It depends very largely upon the coal from the United States.

ships in southern Quebec have the world's largest known deposits of asbestos and are the world's largest producer. Some asbestos is obtained by underground operations and some from open pits. The industry centers in the Asbestos-Thetford area northeast of Sherbrooke (Fig. 242). Peninsular Ontario produces some petroleum and natural gas, which is of considerable local significance.

Taken as a whole the Great Lakes-St. Lawrence Region is Canada's premier producer of minerals (Fig. 241). It mines annually more than four-fifths of Canada's output of gold, one-third of the silver, seven-tenths of the copper, three-fifths of the total mineral wealth, three-fourths of the world's nickel, and four-fifths of the world's asbestos. It is without coal and has little iron and oil. The new titanium-iron mines in the Lake Allard district of Quebec have a daily output of about 500 tons of iron and 700 tons of titanium concentrate. The present mineral-producing areas are widely scattered and give rise to isolated settlements whose future is dependent upon the mines.

WATER POWER

Here we have the most highly developed portion of the Dominion, yet without coal! Its factories and homes have been as dependent upon the United States for coal as has any section of that country, since Nova Scotia coal could not compete beyond Montreal (Fig. 243). Any country dependent on a foreign source of power is in a critical position. Even though its imported coal came from a friendly neighbor, Canada had no control over the closing of mines by strikes, or the price of coal. This situation became more acute with the increase in population and industrial growth and led to both private and public water power development. Today practically every important industrial center of the region utilizes hydroelectric power and has abundant potential resources accessible (Table XXIII). Quebec and Ontario not only have four-fifths of the water power developed, but have nearly half the potential at ordinary 6-months' flow of the rivers. Nature has endowed few other places in the world with such a large potential of water power—a fact of great significance in a coalless land. This is due to (1) the abundant and fairly uniform rainfall, (2) falls and rapids in the numerous streams that descend from the Canadian Shield bordering the Lowland on the north, and Niagara Falls, (3) the geological structure, and (4) the Great Lakes, and thousands of smaller lakes, muskegs, and forest cover on a comparatively level upland, which serve as storage reservoirs. These conditions give to the region a minimum potential of 13,860,000 hp, with 20,300,000 hp dependable for 6 months. Furthermore, a very large part of these reserves

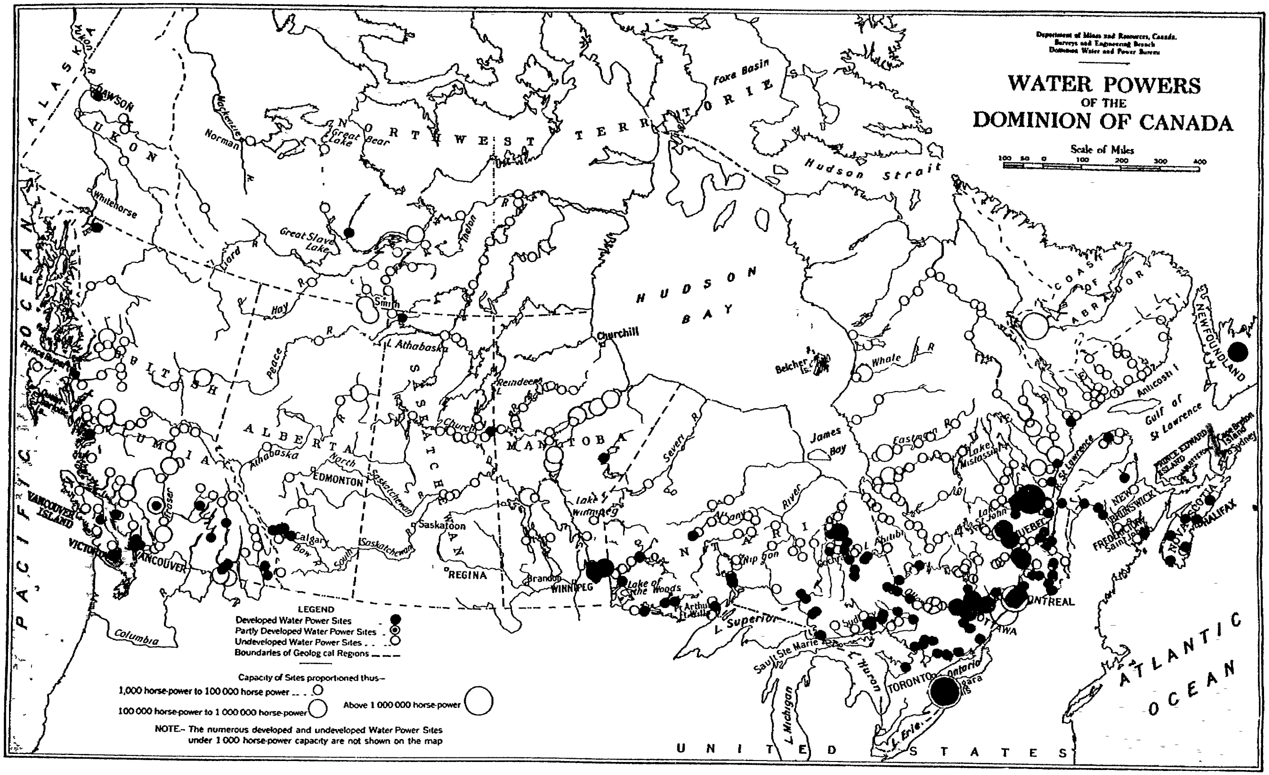


Fig. 244. Water power of Canada. *Department of Mines and Resources.* Most of the developed water power of Canada is in the Great Lakes-St. Lawrence region—The Acute Fuel Area. Compare with Fig 243. Ontario and Quebec now have four-fifths of the developed water power of Canada, and about half the potential. The numerous developed and undeveloped water-power sites under 1000-hp capacity are not shown.

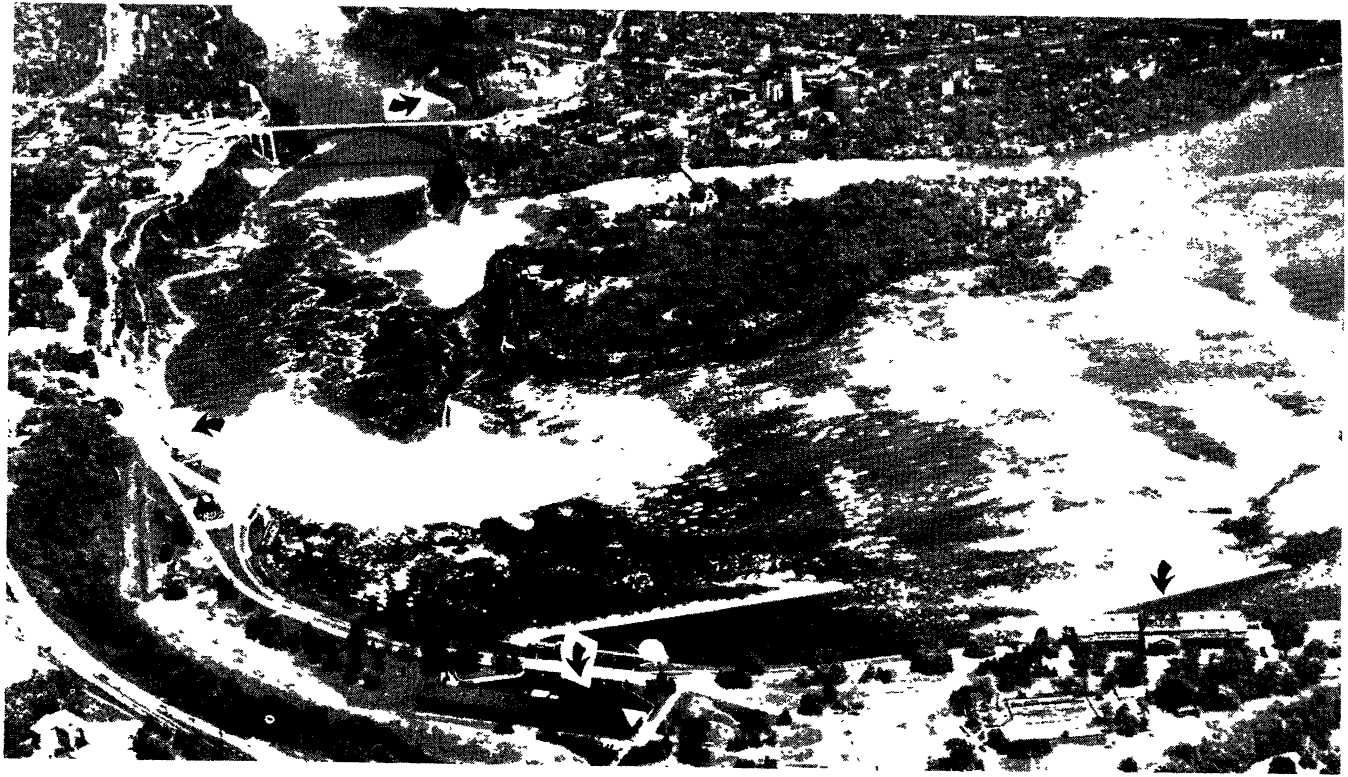


Fig. 245. Niagara Falls is an important source of power. Canadian plants are in the foreground *Courtesy, Niagara Mohawk Power Corp* Arrows indicate location of several power plants. Others are farther down the gorge.

is located near centers demanding power, and the reserves are well distributed throughout the region (Fig. 244). Ninety-eight per cent of the electricity now produced in Canada comes from central power stations.

TABLE XXIII

POTENTIAL AND DEVELOPED WATER POWER OF CANADA

	Potential Horsepower			Turbine Installation	
	At Minimum Flow (000)	At 6-Months' Flow (000)	Percentage 6-Months' Flow of Total	Horsepower, Jan. 1, 1950 (000)	Percentage of Total
Quebec	8,459	13,064	30.4	6,130	52.7
British Columbia	7,029	10,998	25.6	1,238	10.6
Ontario	5,407	7,261	16.9	2,896	24.9
Manitoba	3,309	5,344	12.4	557	4.8
Newfoundland	1,135	2,585	6.0	262	2.2
Saskatchewan	542	1,082	2.5	111	0 9
Alberta	507	1,258	2.9	107	0.9
Yukon and Northwest Territories	382	814	1.8	28	0.2
New Brunswick	123	334	0.7	133	1.1
Nova Scotia	25	156	0.3	145	1.2
Prince Edward Island	—	3	—	2	—
Canada	26,914	42,899	99.5	11,613	99.5

A network of transmission lines extends throughout the Lowland and the southern portion of the Shield. The rapid development has been due largely to the need for power in a coalless land, and to the rapid growth of the pulp and paper industry. Nearly 500,000 hp is developed by and used directly by that industry in addition to the power purchased from central stations. Fully 90 per cent of the machinery of the pulp and paper industry is driven by water power. The Province of Quebec is the largest

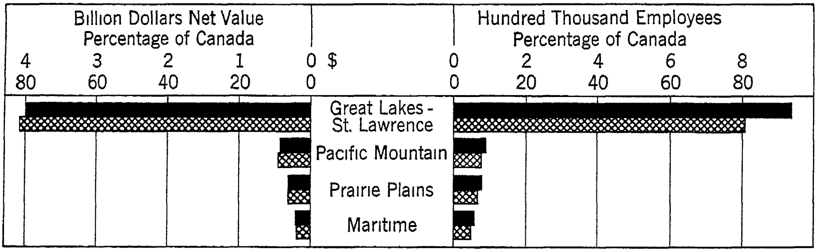


Fig. 246. Manufactures of Canada, by regions.

user, industrial development being so closely associated with the utilization of its forests. The power reserve of the region is sufficient to meet the needs of a much larger population and a much greater industrial development.

MANUFACTURES

The Great Lakes-St. Lawrence Region is the premier manufacturing area of Canada, producing more than four-fifths of the net value and having a like proportion of the employees (Fig. 246). In spite of the rapid growth of manufacturing in other sections, such as British Columbia and the Prairie Provinces, it continues to maintain its relative position. Many factors have favored manufacturing development in this region, such as: the stimulus of two world wars; the Great Lakes-St. Lawrence waterway; variety of natural resources—forests, minerals, water power, agricultural lands; accessibility of iron ore from the Lake Superior district and Penn-

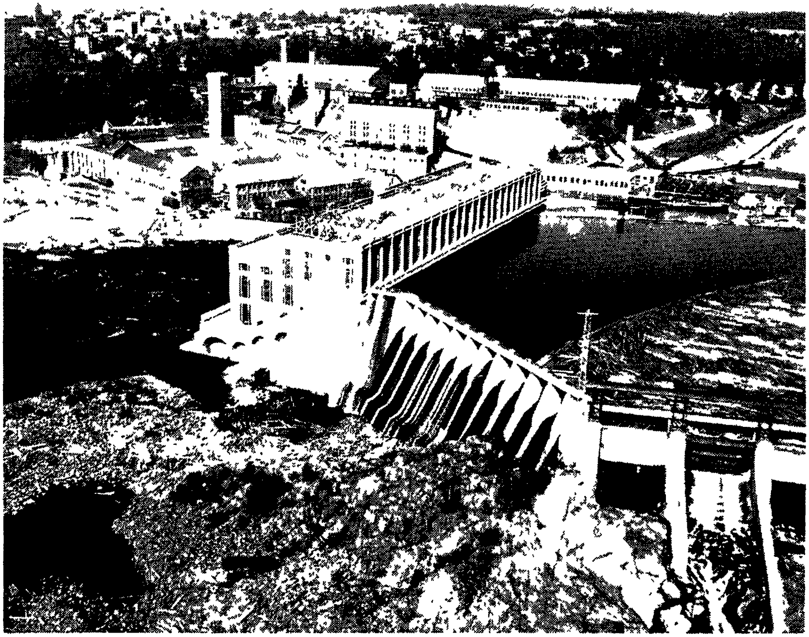


Fig. 247 A large paper mill at Grand Mere, Quebec. *Courtesy, Royal Canadian Air Force.* Scores of such mills now utilize the abundant water power of the St Lawrence region

sylvania coking coal; large local population and accessibility of foreign markets in the United States and overseas; an able and industrious people; a tariff-protected home market and preferential rates in other parts of the British Empire. Many United States corporations have branch plants here, thus gaining tariff advantages, and accounting for much of the industrial development. Probably the greatest effect of producing for war purposes was the stimulus given to metal-working industries. This is especially noticeable in Ontario and is evident in Quebec. In both areas the abundant water-power resources have been utilized effectively.

TABLE XXIV

Leading Manufacturing Industries of Ontario and Quebec

	Net Value (000)	Percentage of All Industries	Number of Employees	Percentage of All Employees
Ontario				
Electrical products	146,043	6.8	35,518	6.6
Pulp and paper	115,462	5.4	16,927	3.1
Automobiles	109,754	5.1	23,281	4.3
Rubber goods	91,768	4.2	16,795	3.1
Machinery	81,711	3.8	17,417	3.2
Primary iron and steel	67,258	3.1	17,658	3.2
Automobile supplies	61,359	2.8	16,424	3.0
Non-ferrous metals	57,590	2.6	7,192	1.3
Quebec				
Pulp and paper	171,518	12.9	23,675	6.2
Clothing, women's	60,697	4.5	20,300	5.3
Electrical products	51,657	3.9	16,285	4.2
Clothing, men's	50,096	3.7	16,180	4.2
Non-ferrous metals	42,319	3.1	6,203	1.6
Railway rolling stock	40,527	3.0	13,339	3.5
Tobacco products	39,236	2.9	8,332	2.1
Cotton yarn and cloth	35,809	2.7	16,388	4.3

Manufacturing as a whole is based upon utilization of local raw materials, products of forests, mines, and agricultural lands, but much raw material is imported for processing. The outstanding industry of Quebec —pulp and paper (Fig. 247)—is based upon its forests and water power. Quebec produces about half the total output of Canada, and ships pulpwood and pulp for paper manufacture elsewhere. The textile and aluminum industries depend upon a foreign source for raw materials. Textiles are a very old, established industry and have maintained a leading position in the Dominion. Other industries include production of chemicals, railway equipment, non-ferrous metals, electrical, tobacco, and creamery products.

More than half the manufacturing industry of the Dominion is concentrated in the Ontario section. Its industries are highly diversified, but metal working industries occupy the leading position (Table XXIV). Many of these are subsidiaries of United States companies or became well-established war industries and have continued to thrive. Automobiles and electrical products are examples.

CITIES

With the development of manufacturing on a modern factory scale, people tend to concentrate in small areas; hence large urban centers arise. Three-fifths of Canada's people live in the Great Lakes-St. Lawrence Region, and nearly all are in the Lowland. Nearly two-thirds of the population of the region is urban, and this proportion is increasing yearly, a situation that indicates the increase in manufacturing that is taking place. All except two of the metropolitan centers of Canada having a population of more than 100,000 are located here. Because of the numerous natural assets previously named, this region has offered the greatest opportunities to man in the past and, for the same reasons, is likely to do so in the future. It appears unlikely that man will ever find any similar area of the Dominion so well adapted to his needs.

Montreal is the largest city. It is situated in the midst of the Lowland and in the most populous section of Canada, at the head of ocean navigation on the St. Lawrence, 300 miles nearer to Europe than New York is. It is at the foot of inland navigation on the Great Lakes, where railroads from the interior converge, and has an abundance of available water power. It leads in manufacturing and in foreign trade, even though its port is closed by ice for more than 4 months of the year. Its location makes it the most convenient and economical center for transshipment of exports and imports of both central and eastern Canada. It ranks among the world's grain ports, and handles a large share of Canada's total exports and imports. The leading exports include wheat and wheat flour, other grains, lumber, and woodpulp and paper; and the principal imports handled are raw and manufactured cotton, raw and manufactured wool, raw sugar, tea, and numerous manufactures. *What effect will the completion of the St. Lawrence Seaway project have on Montreal? Would you expect Montreal to support the project?*

Toronto is the second city of Canada in population and industrial development, and is the gateway to the southwestern lowlands, which are one of the most densely populated and wealthiest parts of the Dominion. It has a good lake harbor, is the railway focus of the section, and is the distributing center of a prosperous agricultural and manufacturing district. These advantages make it a close rival of Montreal. Other cities of 100,000 or more population are Windsor, Hamilton, Ottawa, and Quebec.

Quebec, the French-Canadian capital, with its ancient citadel, gray stone buildings, and "Lower Town" with its winding passages, narrow streets, and old houses, is one of the most picturesque cities in America. Located on the St. Lawrence where the Lowland begins, and over 100 miles northeast of Montreal, it is in a much less favorable position for commercial development. It has a large passenger traffic from ocean vessels that do not ascend to Montreal, and from passengers who desire to start the railway journey as soon as possible. It has large available water-power resources, and its railroads provide good connections with the Maritime Provinces and a more rapid access to the northwest than by way of Montreal. Its foreign trade is similar in many respects to that of Montreal. It typifies the lower St. Lawrence Lowland, of which it is the center. Along the great river highway that leads from the open ocean far inland, the explorer, voyageur, settler, traveler, as well as commerce and modern industry, have, in large part, passed by these lowlands to the head of navigation at Montreal, thus reminding one of "ships that pass in the night." The people of these lowlands have been left very much to themselves in a somewhat isolated relation to the rest of Canada. Here the French population, devoted to their religious faith, undisturbed by the passing tide of modern life, has developed a strong self-reliance and has retained many of the customs and much of the outlook on life of a century past. This evolution of a French Canada within the Dominion is in part the product of a natural environment which provided isolation yet permitted the progress made by several generations of other peoples to pass through it, wielding only a relatively small influence in the passage. Those at home now produce for, but are scarcely a part of the world outside. However, as a result of the high birth rate and pressure of population on local resources, the French Canadians are spreading into adjoining areas, and even migrating to distant parts of the Dominion. The strength of this ethnic group in Canada is evidenced by the recognition of both French and English as official languages.

PROBLEMS

1. Will the St. Lawrence Lowland continue to be the leading manufacturing and commercial section of Canada?
2. Do the water-power resources of the St. Lawrence Lowland compensate fully for its lack of coal?
3. Can Montreal maintain its position as the leading city and port of Canada?
4. Would free trade with the United States benefit the St. Lawrence Lowland?

5 The proposed Great Lakes-St. Lawrence Seaway would be of greater benefit to the St Lawrence Lowland than to any other part of Canada.

6. Is the St Lawrence Lowland dependent upon the Prairie Plains Region for a large part of its present industrial development?

7 Can the St Lawrence Lowland maintain twice or three times its present population?

8. Will agriculture and the industries based thereon be of greater importance than the forest industries?

9 Can the industrial development of the Great Lakes-St. Lawrence Lowland Region equal that of the Great Lakes section of the United States?

10. Will the St. Lawrence Lowland continue to maintain its dominant position in the Dominion?

CHAPTER 23

The Prairie Plains and Arctic Meadows

THE PRAIRIE PLAINS REGION

The Prairie Plains Region, for the purpose of this discussion, is the comparatively level, rolling country forming the southern portion of the great interior plain of Canada. Its northward limit in the west is an indefinite belt including the Peace River Valley, and in the east the Canadian Shield. From north to south it is divided into three natural belts. (1) The northern portion is a forested region, along the southern border of which are (2) numerous open grassland areas, whereas (3) the southern portion is true grass-covered prairie which merges into semiarid conditions at the southwest. The region is 800 miles wide along the international boundary and about half that width in latitude 56° north. From east to west in the southern part it is divided into the three prairie levels previously described. The first of these includes the approximately flat Red River Valley, famed for its fertile soils and immense wheat fields. The undulating surface of the second and the relatively level surface of the third are likewise noted for their vast expanse of potential agricultural land, which stretches out in all directions beyond the vision of the traveler.

Except for about 12,000 square miles in the southwest, the whole region drains eastward to Hudson Bay or northward to the Arctic Ocean, the largest drainage basins being the Saskatchewan, Peace, and Athabaska Rivers. The Saskatchewan River is considered navigable for shallow-draft vessels for 800 miles; the Athabaska, from Athabaska northward; and the Red, from United States territory to Lake Winnipeg, which is navigable throughout its length.

Because of tortuous courses, low water, rapids and other obstructions, unsuitable outlets, and the greater dependability of railroads through the year, and especially that part of the year when crops go to market, the rivers are of negligible commercial value. The streams of the southwest are used for irrigation purposes, a use which is likely to increase in importance. About one-sixth of the Dominion's minimum potential water power is in this region, with more than three-fourths of it in Manitoba (Table XXIII). This is an asset of great significance, owing to the sparsity and poor quality of the coal in Manitoba and Saskatchewan. The present water-power installation in the region, however, is less than a seventh of the minimum power available. This reserve will be available for manufacturing and irrigation as the region continues to develop. In contrast Alberta has very large power resources—water, coal, petroleum, and natural gas.

The distribution of people agrees very closely with the network of railways and the grain regions. The population of Saskatchewan is nearly

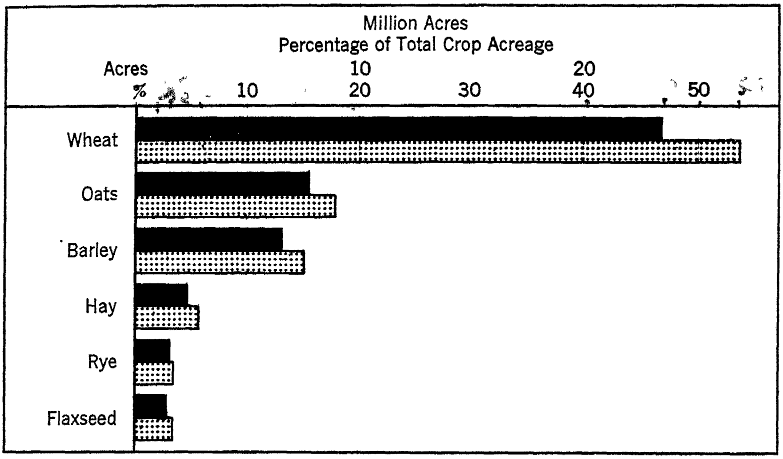


Fig. 248. Principal crops of the Prairie Plains region. The Prairie Plains region is a land of cereals among which wheat and oats occupy a dominant position. These six crops occupy 98.8 per cent of the crop acreage.

the same as that of Alberta, and the population of each exceeds that of Manitoba. However, the population of Alberta is increasing and that of Saskatchewan is decreasing. There has been a definite trend toward urban centers throughout the Prairie Plains, accompanying the growth of manufactures. The rivers have been of little significance in locating the people, as they are not commercially navigable nor do they lead to a satisfactory outlet. The total population has declined since about 1940. Since agriculture is the dominant industry, nearly three-fifths of the population is rural. Saskatchewan, which has few large towns or cities, has more than three-fifths of its population on farms. More than half the inhabitants of the region are of British origin, though it has a number of other population groups. Among other ethnic stocks are German, Ukrainian, Scandinavian, French, Polish, and Russian, though each is small in number compared with the British. More than two-fifths of the people of Manitoba are in metropolitan Winnipeg.

Agriculture. The Prairie Plains, in contrast with the Great Lakes-St. Lawrence Lowland, is a region with one dominant interest, viz., agriculture. All other activities are of relatively small importance, although marked changes are in progress. The great extent of level, fertile, arable land, ready for the plow without clearing; approximately 90 days' growing season with many hours of sunshine; high summer temperatures; a fair supply of rainfall in the growing season with dryness later in the summer; and snowfall in the eastern portion to supply early spring moisture have made it an especially suitable region for the growing of hardy grains of high quality. Its extensive grasslands are well adapted to grazing. However, the short growing season, fluctuation in rainfall, small rainfall margin of safety, frequent hailstorms in June and July, and early autumn frosts are limiting geographic factors. The region produces half the net agricultural revenue of Canada, though only a seventh of its arable land is cultivated.

Leading Crops. The nearly flat to gently rolling plains are preeminently a land of grains (Fig. 248). From the vantage point of a slight hill elevation, or from the air, clusters of grain elevators dot the landscape and stand out like beacons on a treeless sea of farms and ranches. Each cluster marks the site of a town or city designed to serve an agricultural community. The three leading cereal crops are wheat, oats, and barley, whether measured in acreage, bushels, or value; crops of secondary importance are hay and forage, rye, flaxseed, and potatoes. Wheat is distinctly the pioneer crop, as it is easy to raise, and provides money for buildings and the purchase of livestock. This cash crop enables the settler to diversify his income later. Seven-tenths of the 43,160,000 acres devoted to field crops produce wheat and oats, the acreage of wheat being more than three times that of oats. However, the value of wheat represents nearly 60 per cent of the total crop value of the region, indicating the great importance of this crop in the agricultural economy of the Prairie Plains. In Saskatchewan wheat contributes nearly 70 per cent of the total value. It is chiefly upon this crop that the prosperity of the region depends, and the interior position and consequent great distance to foreign markets is a serious handicap. Low wheat prices bring economic distress.

The wheat belt is limited in the southwest by semiaridity, and on the north by relatively cool summers and a short growing season. The wheat district is a continuation of the spring-wheat section of the United States, and all the wheat produced is of the spring variety. Most of it is grown on the first and second prairie levels of Manitoba and Saskatchewan where

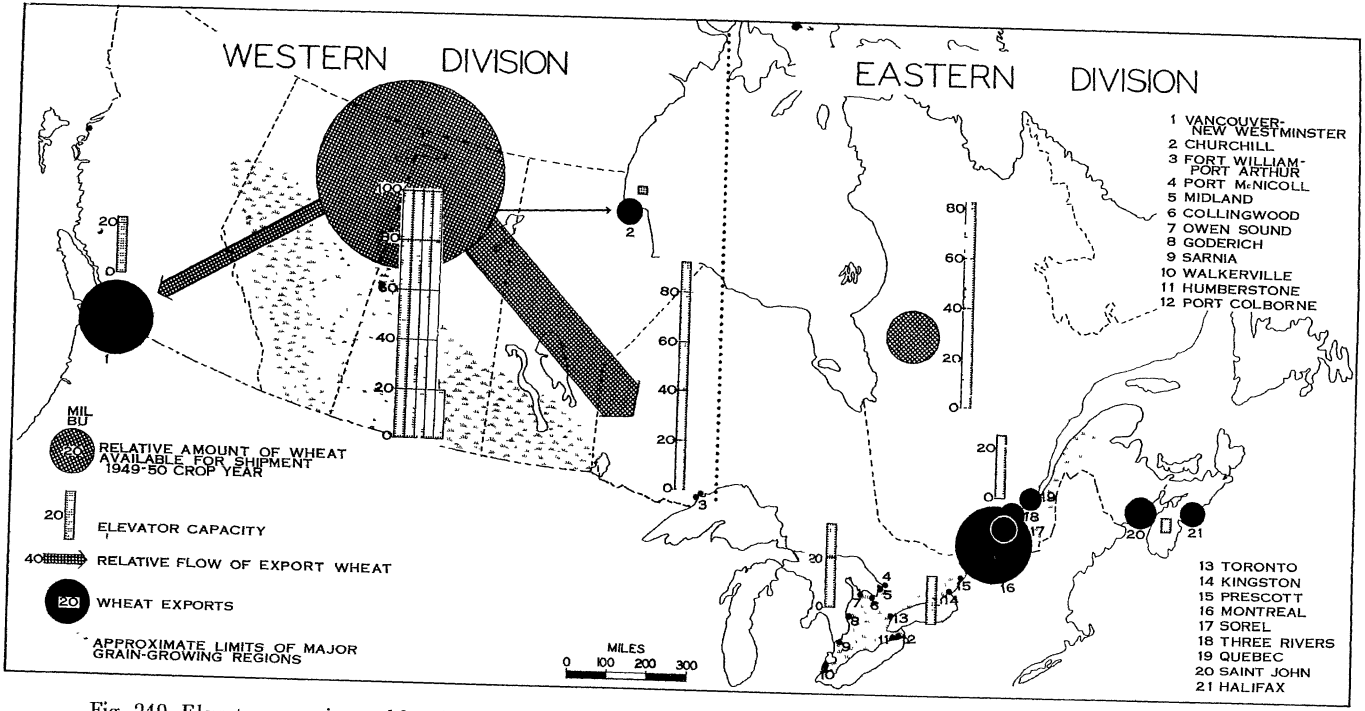


Fig. 249. Elevator capacity and leading export centers. *Data from Statistical Branch, Board of Grain Commissioners of Canada*

the soils are similar to the chernozem or "Black Earth belt" of Russia and the black Prairie Soils of the United States. Spring wheat is also grown in south central Alberta where the warm Chinook prevails and the winters are shorter and milder than in other portions of the region. The dry climate is also an important factor in producing a very hard wheat.

The present distribution of the second crop—oats—is similar to that of wheat, except that it is commonly associated with mixed farming and the maximum acreage lies along the northern margin of the wheat belt where the growing season is shorter and cooler than that required for wheat. The land devoted to oats is less than a third that of wheat, and the value only a fourth. Barley and flaxseed center in the first and second prairie levels, where most of these crops are grown. Both crops are well adapted to the climatic conditions imposed by high latitudes, and flaxseed will thrive under extremes of heat and drought. Flax is grown

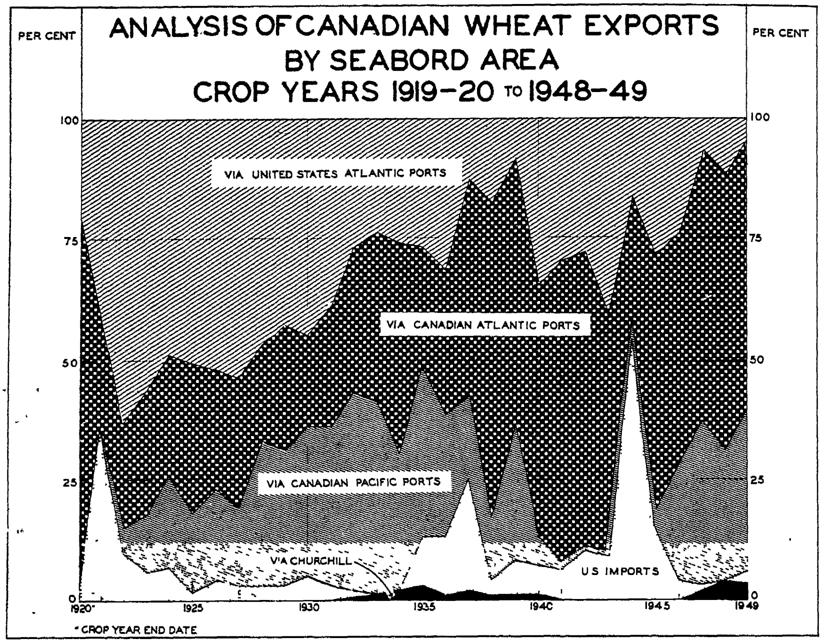


Fig. 250. Direction of export wheat. The great bulk of the wheat moves eastward to Atlantic ports. *Courtesy, Canadian Board of Grain Commissioners.* The interior location of the great wheat-producing region necessitates an extensive system of rail and water transportation, storage capacity, and export facilities. About three times as much wheat moves to eastern as to western mills and ports for export.

exclusively for seed, and usually on newly plowed prairie sod, as a "breaking" crop and because it is susceptible to disease when raised continuously on the same land. The distribution of cultivated hay and forage is similar to that of other crops. However, a large part, and probably most, of the annual crop comes from wild grass of the prairie; hence a considerable amount is produced beyond the cultivated districts.

Movement of the Wheat Crop. As in other new regions of small population and large production, most of the crop finds a market outside the region in which it is grown. Two-thirds or more of the wheat, but only a small proportion of the oats, is shipped out of the region, as the oats is used for stock feed locally. Thousands of elevators along the network of railroads that serve the region receive the grain from the farms. Practically all the wheat moving to the Atlantic seaboard utilizes the Great Lakes route, indicating the significance of those water bodies in marketing the crop. About two-thirds of the wheat shipments from the region go out through Fort William-Port Arthur (Fig. 251), which has very large elevator capacity. Figures 249 and 250 show the elevator capacity that has been built at major centers to serve storage and transit needs and relative importance of export ports. By far the largest share of the eastbound wheat follows the all-water route to ports on the St. Lawrence, Montreal being the principal one. Port Colborne and Buffalo are the leading ports on Lake Erie. An increasing amount is moving west by rail to Pacific ports. Vancouver-New Westminster now surpasses Montreal in elevator capacity, and its wheat exports are only a little smaller. Other minor routes are (1) by rail to Churchill on Hudson Bay (Fig. 252), (2) by rail and water to Georgian Bay and then by rail to eastern points.

Out of Canada's total overseas exports of wheat through Atlantic seaboard ports nearly a sixth passes out by way of United States ports, principally Baltimore and Philadelphia. This relatively small United States movement of Canadian grain is due to a number of geographic and non-geographic causes. The United States ports are open all year, whereas Montreal is open about 7 months; ocean insurance and freight rates are correspondingly lower than from Montreal; there is greater certainty of securing ship space when needed; both Canadian and United States lake vessels may carry the crop to United States ports, whereas only Canadian Lake vessels may carry the crop to Canadian ports and there are not enough such vessels to handle the crop.

The development of Vancouver as a wheat-exporting port is comparatively recent. In 1920 Vancouver handled 600,000 bushels, and in 1948–1949 more than 60,000,000. Adequate facilities for handling large quantities of grain have been provided, and it appears probable that annual wheat shipments by way of the Vancouver-Panama route to the markets of Europe will increase. Though Vancouver is twice as far from Liverpool by sea as Montreal is, the rail haul for wheat from Calgary to Vancouver is 640 miles less, and from Edmonton 460 miles less, than from those respective cities to Fort William-Port Arthur at the head of the Lakes. Vancouver also has the advantage of but one transfer—from rail to elevator and directly into an ocean-going vessel.

Livestock. The livestock industry has really just begun in the region, though the wild prairie grass provides excellent pasture, and cattle and horse ranches have existed for many years. With the advancement of settlement, many ranches suitable for crops were broken into farms, and the rancher had to seek the rougher and less desirable parts of the region for grazing purposes. To raise stock intensively, however, requires considerable capital, and the severe climate necessitates warm buildings, the timber for which is not available on the treeless prairie. Moreover, several years are required to raise a herd of cattle, and the returns on the investment are small at first. Since land was abundant and cheap, and little capital was required to produce grain, the settler cultivated the soil in order to obtain quick returns. He has, therefore, just begun to develop mixed farming and livestock raising, and considerable progress has been made since about 1930.

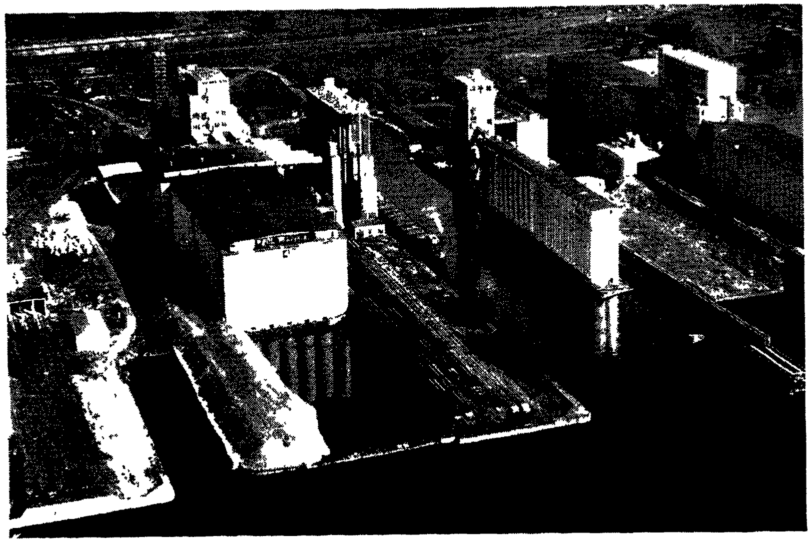


Fig. 251. A few of the grain elevators in the Fort William-Port Arthur harbor. *The Photographic Survey Corp., Ltd., Toronto, Ontario. Courtesy, Chamber of Commerce, Port Arthur.*

Cattle are the most important livestock in both number and value.

They are produced throughout the region, but occur in greatest numbers on the first and second prairie levels where most of the crops are grown, and in south central Alberta on the third prairie level where the Chinook produces a milder winter and melts the snow, making winter grazing possible, thus lessening the cost of shelter and feed. This district exceeds both Saskatchewan and Manitoba in the number of cattle, hogs, and sheep, but is exceeded by Saskatchewan in the number of dairy cattle. Many of the milk cows at present are principally breeding stock for beef purposes. However, the dairy industry has made a substantial growth, with the

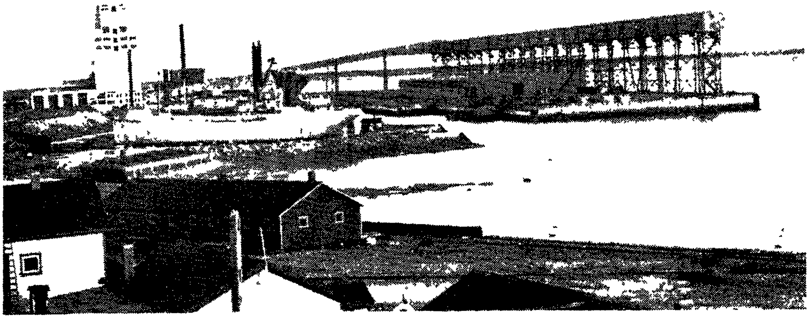


Fig. 252. The harbor and grain elevator at Churchill. *Photo by Miller.*

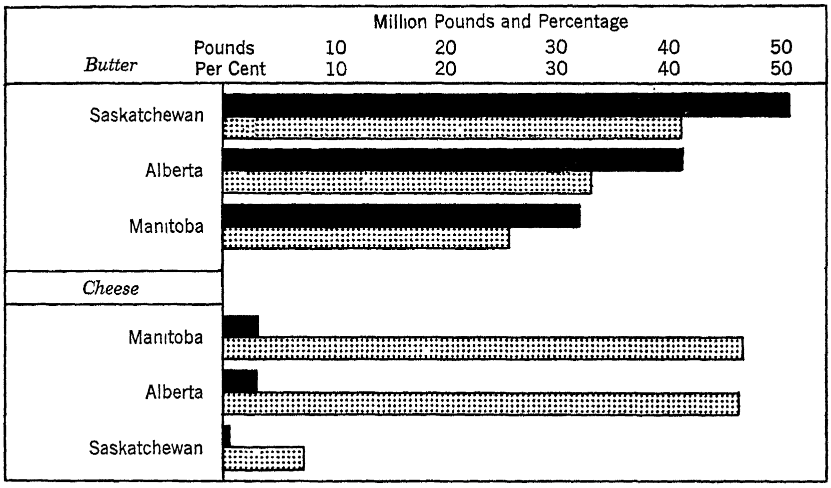


Fig. 253. Butter and cheese production in the Prairie Plains Region. Three-year average.

value of raw milk alone nearly $125,000,000. Additional value is attained by production of nearly 125,000,000 pounds of butter and 7,000,000 pounds of cheese. These two products having high value per pound, compared with milk, can better absorb the cost of transportation to distant markets. The dairy industry has thus become an important source of cash income. Saskatchewan leads in butter production, and Manitoba and Alberta in cheese (Fig. 253). Swine are found in the more settled portions of the region where abundant food crops are grown, such as barley and oats, or where dairy by-products are available. The number, however, is small, and they are slaughtered primarily for local use.

The Future. Measured from the standpoint of so-called "arable" land, a bright agricultural future for the region appears assured, as only about one-seventh of the area estimated as capable of cultivation is now used for field crops. With the present average yield and a 4-year crop rotation, the Prairie Plains are capable of producing 880,000,000 bushels of wheat or 6,900,000,000 bushels of oats annually, and other crops in proportion. However, "arable" land is not the only factor that enters into successful agriculture, and it is probable that the amount of such land has been overestimated. The climatic conditions limit the number of crops that are well adapted to rotation, and it is not likely that all arable land has equal productive value; hence such a production is not likely to be maintained if ever reached. Such figures merely indicate that potential agricultural resources are large and capable of sustaining a much larger population. Diversified farming, the use of fertilizers, the growth of domesticated hay and forage, and the raising of livestock for both meat and dairy purposes may lead to a substantial agricultural growth in the future. The extension

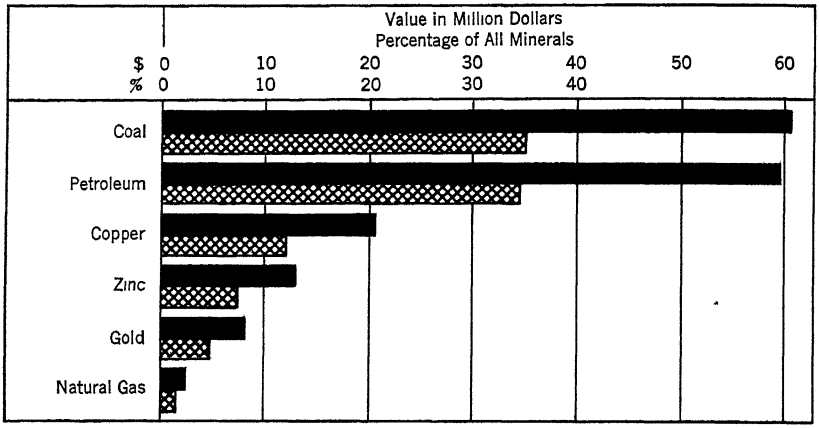


Fig 254. Principal minerals produced in the Prairie Plains Region.

of irrigation in the semiarid southwest, where more than 400,000 acres are now irrigated, will be an additional contributing factor. This district now has more than 2,460,000 acres of irrigable land in organized projects. When completed, other projects in Saskatchewan will provide water for 105,200 acres.

Minerals. This region of farming and grazing land is deficient in minerals compared with some other regions of Canada, though coal, petroluem, copper, zince, gold, natural gas, clay products, and silver are produced. The first four are the only ones that approach large production (Fig. 254). The metallic minerals are produced in the Shield portion of the region, north of the prairies, and nearly all come from the Flin Flon-Sherrit Gordon area on the Manitoba-Saskatchewan border. A considerable area in southern Saskatchewan and a large part of Alberta are underlaid with coal. The Saskatchewan coal is lignite, but near the base of the Rockies the coal improves in quality and increases in quantity, and essentially all coal in Alberta is bituminous and subbituminous. The probable reserves of Alberta are estimated to be about 35,000,000,000 tons, and coal is now the leading mineral produced. The Crow's Nest field is one of the most important in production and quality; Lethbridge and Edmonton produce a lower-grade coal, chiefly for the local market.

More than 95 per cent of Canada's petroleum comes from the Prairie Plains Region. For many years Turner Valley was the chief source, and it is still an important contributor to Alberta's total output. The Leduc-Woodbend field, southwest of Edmonton, now leads. Other large producers are the Redwater area northeast of Edmonton, and Lloydminster on the Alberta-Saskatchewan border (Fig. 255). Lloydminster produces a heavy oil used extensively as railway locomotive fuel. The crude-oil production capacity is much greater than local refining facilities. The new pipe lines to Sarnia and Vancouver, carry crude oil to eastern and western refineries and provide an outlet for greater production. Usually, about 90 per cent of Canada's consumption of crude and refined oil products is imported. The potential reserve of these new fields indicate that imports will be reduced greatly, if not eliminated. The enormous deposits of tar sands and "liquid bitumen" in the McMurray region are practically untouched. The Alberta Government is now operating a small refinery at Bitumount. Alberta also produces more than four-fifths of Canada's natural gas. A projected pipe line, when completed, will provide a market in British Columbia, Washington, Oregon, and California.

The Peace River Region. The Peace River district is of special interest as a frontier, because of its high latitude (55° to 58°) in the lee of the Rockies, its many hours of daily sunshine in the summer months, its low but effective rainfall, its Chinook winds, and its agricultural productivity

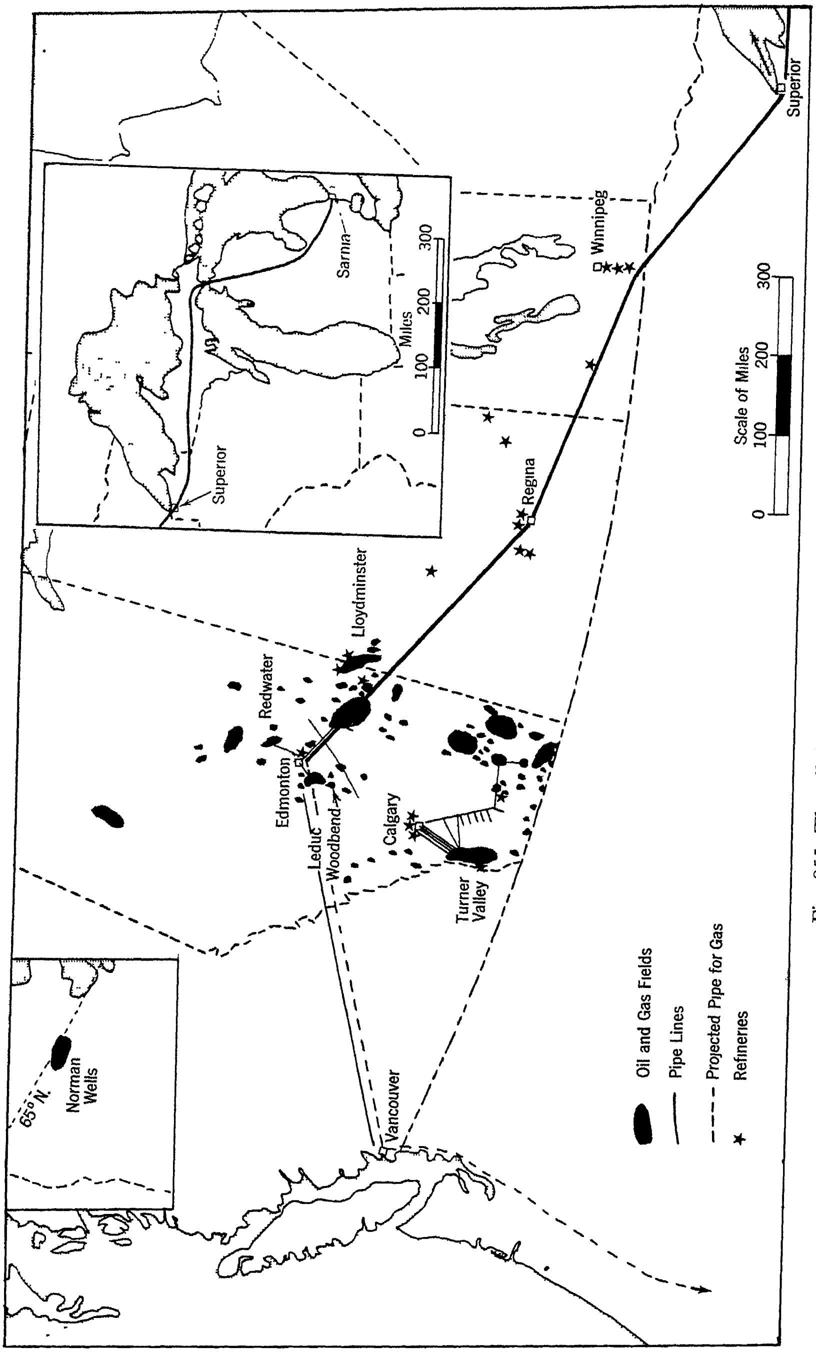


Fig. 255. The oil fields of the Prairie Plains Region.

and potentials. Its southern border is in the latitude of the south shore of Hudson Bay and its northern in that of Churchill, or nothern Labrador. However, the tundra landscape of Churchill and Labrador is in striking contrast with rolling, forested, morainic hills and farmlands of the Peace River country. The average annual rainfall is only about 15 inches, with a summer maximum, and winters are cold and summers warm. Chinook winds are a pronounced feature and bring balmy days to break the steady cold of the long winter. Spring arrives quickly and early, seeding is done from the middle of April through May, and the crop is harvested from the middle of August to the middle of September. Snows reach the region about the middle of November, and winter closes in.

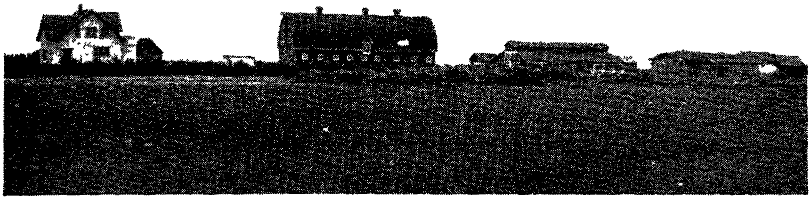


Fig. 256. A farm home near Grimshaw. *Photo by Miller.*

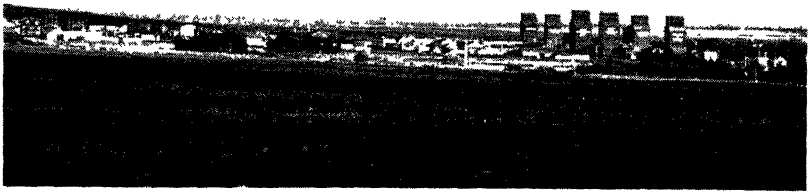


Fig. 257. Typical agricultural community in the Peace River country. *Photo by Miller.*

Estimates indicate that the upper drainage basin of the Peace contains about 14 to 18 million acres of potential agricultural and grazing land. Only a small portion is now utilized by the present population of some 60,000. Agricultural development is localized in areas separated by bush and forest. Some of the wooded area has poor sandy soil, but much of it is good potential agricultural land. It is probable that the best Dark-Brown to Black Podzolic Soil areas with adequate transportation facilities have been occupied, and the new settler will have to accept the less desirable. The hills of the region are commonly warmer than the lowlands, the difference often being as much as 28°. The high lands are well suited to grain, and the region is noted for its high-grade wheat. The low areas are very good for grass and hay crops, and much hay and lawn-grass seed are produced, especially bromegrass seed for hay and creeping red fescue seed for lawn grass. Other crops include oats, barley, buckwheat, vegetables, apples and small bush fruits. Cattle are the chief livestock. The farm lands and excellent farm homes about such centers as Grand Prairie, Sexsmith, Beaverlodge, Grimshaw (Fig. 256), Clairmont, and Rolla rival similar areas in Iowa. However, on the margin many log homesteads are still in the primitive frontier stage. The relative importance of agriculture, about the various village centers, may be judged by the number and size of the grain elevators, which are conspicuous features of the cultural landscape (Fig. 257). At present transportation costs to distant markets are too high to encourage agricultural expansion. The full productive capacity of the region will not be utilized until an adequate outlet has been provided westward to the Pacific. Even the development of its oil, natural gas, and coal resources can supply only a small additional local market.

Manufactures. Little manufacturing, compared with Ontario, has been done in the Prairie Plains country in the past. Since there is little water power except in the extreme western and eastern parts, and suitable coal in abundance only in the far west; since labor is scarce, opportunities for individual endeavor plentiful, and the market limited by sparse population, manufacturing on an extensive scale is not to be expected. However, industry has made substantial progress. Present manufacturing enterprises are related closely to the use of local raw materials, and include those types that serve the needs of a local community. Slaughtering and meat packing, and flour and feed mills account for one-third of the total value, followed by butter and cheese, and petroleum products (Fig. 258). The two leading industries rank first and second in each province. Manitoba with the concentration in metropolitan Winnipeg, ranks first in slaughtering and meat packing, and Alberta second. Saskatchewan leads in butter and cheese, Alberta in flour and feed mills and petroleum products, and Manitoba in railway rolling-stock.

Cities. Nearly all cities and towns of the Prairie Plains are based on an agricultural economy. They are centers for the collection, processing, and shipping of agricultural raw materials, distribution of manufactured products, and manufacturing, for the area served. Calgary and Edmonton might be considered partial exceptions because of petroleum refining, and, likewise, a few small centers based on mining. In the early days of settlement towns tended to locate at the intersection of railways, or along them, where agricultural conditions were good, and where their prosperity depended upon that of the tributary agricultural community. Winnipeg, Calgary, Edmonton, Regina, Saskatoon, Moosejaw, and Brandon owe their location and importance primarily to these causes. Calgary and Edmonton have grown to cities of more than 100,000 population.

Metropolitan Winnipeg is by far the most important, and with a population of about 300,000 it is the second-largest city west of the St. Lawrence Lowland. Its location in the narrow gap between Lake Winnipeg and Lake of the Woods directs all railways and all traffic from the eastern and western parts of Canada through it. Its hinterland is the whole region, as most of the produce of the region passes through it on the way to the eastern markets of Canada, Europe, or the United States, and manufactures and other articles enter it for distribution to the region. It is, therefore, the commanding entrepôt of the Northwest. It has excellent water power available for industrial development. The growth of Winnipeg has corresponded with that of the Prairie Plains country which it serves, and its future progress will be determined by the development attained by the same area. Owing to its commanding position in a great agricultural area, it is frequently called "The Chicago of Canada."

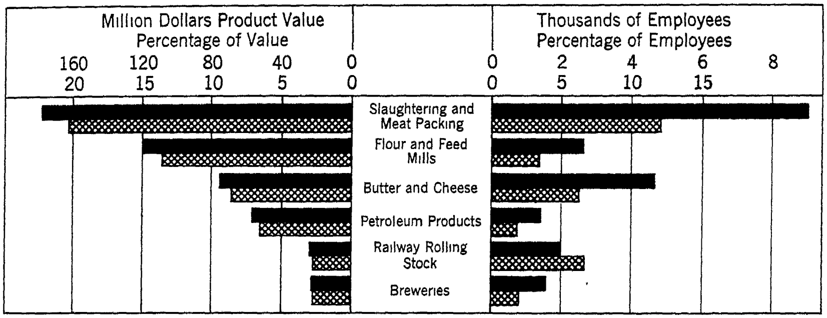


Fig. 258. Leading manufactures of the Prairie Plains region. These six account for more than half of the total value.

THE ARCTIC LANDS

A Vast Area. Far to the north, extending from the shores of the Arctic Ocean southward to the forests, lies an immense expanse of arctic meadow or tundra. More than 760 varieties of flowering plants, 330 varieties of mosses, and 28 of lichens are known to thrive natively upon its surface, and in many places the flowers, mosses, and lichens are completely obscured by the growth of grass, sedges, and the like. A still more northerly extension of the area includes many of the arctic islands and much of the shore of Greenland. Summer-season temperatures of 80°–100° are not uncommon near the Arctic Circle, though the average temperature is much less. During the many hours of continuous sunshine, vegetation grows with great rapidity. Latitude 70° N. may have sunshine for 73 days continuously except when the sun may be obscured by clouds; 66½° N. for 24 hours; and 60° N. for 18½ hours. At least several hundred thousand square miles has more than a month of continuous daylight. The winters are long, dark, and cold, but the snowfall is less than that of Chicago. Even the snowfall of Ellsmere Island is only about a tenth of that of St. Louis, Missouri. Most of the arctic land is covered with very little snow at any time of year, as the snow is swept away by the winds. The extreme winter temperatures of the arctic are not as low as those that occur in many places where white men now have comfortable homes. Herschel Island's extreme minimum temperature, −54°, compares faborably with −68° for Harve, Montana, −70° for Prince Albert, and −57° for Edmonton. The Mackenzie River system has been the major route of transportation for many years. More recently the Alaska Highway (Fig. 212) has given direct overland connections with the Yukon area. Airports now dot the Mackenzie Valley and Yukon, and airplane service provides transportation for both freight and passengers. The economy of the natives is based on hunting, trapping, and fishing. Sale of furs enables natives to obtain imported goods. Trapping by natives and white men yields approximately $2,000,000 worth of furs annually. With completion of an all-weather highway from Grimshaw, Alberta, to the Hay River settlement on the south shore of Great Slave Lake, trucks now carry goods north for distribution to Yellowknife, on the north shore of the lake, and throughout the Mackenzie District, and carry fresh fish to southern markets.

The presence of minerals has long been known, though only a relatively small portion of this vast area has been tested carefully. However, mining has become the major industry with an annual output of more than $8,500,000, two-thirds of which is gold. Yellowknife, on the north shore of Great Slave Lake, now surpasses the Dawson-Mayo district of Yukon. A hydroelectric plant about 90 miles north on the Snare River, with an installed capacity of 8350 hp, supplies power for the Yellowknife district. The Norman Wells petroleum field, with a production of about 400,000 barrels, provides fuel and other refined products for the Mackenzie area. Radium and uranium are produced near Port Radium on the east shore of Great Bear Lake. The mines are one of the world's major sources of these ores and the largest in North America.

A Land of the Future. Native animal life is abundant both on the land and in the seas—seal, walrus, whale, fish, caribou, wolf, bear, fox, rabbit, ducks, geese, loon, etc. Caribou occur in millions and roam over the land, from the arctic islands far to the south, in herds containing thousands and hundreds of thousands. The caribou, or wild reindeer, is probably the principal animal of economic interest to man. The grass-eating muskox, or ovibo, is of only slightly less interest, as both animals are extremely well adapted to the region and their meat is excellent. The muskox also yields 10–15 pounds of wool, is a larger milk producer than the reindeer, and has the superior quality of moving about no more than is necessary to obtain food.

Most of the present scant Eskimo population lives along the shores, as fish, seal, and walrus are more dependable sources of food than the caribou, which travel long distances in herds. Today these people live in the hunting and fishing stage of human development. Such has been their history from an unknown date. What of tomorrow? An index to a possible future is the success of the reindeer industry in Alaska. If Alaska can support 3,000,000–4,000,000 (estimated) reindeer upon its grazing area, it seems probable that the Arctic Meadows of Canada can support at least twice as many. Even a much smaller number would provide a surplus of excellent meat and hides, to feed and clothe the people of warmer climes, and would assure a less precarious living to the native population. A beginning has been made by the importation of several thousand reindeer from Alaska to the excellent grazing grounds east of the delta of the Mackenzie River. Progress in building up this herd, and in the training of personnel, is being made at the Federal Government project near Aklavik. Other areas are being studied to determine their suitability for reindeer, and research is in progress to develop additional resources of the region, so as to widen the economy of the native population. Perhaps the muskox, or some hybrid obtained through it by breeding, may prove more profitable than the reindeer or better adapted to some sections. Such seems to be a possible future utilization of the resources of this region. When that time comes the population will increase, but will never be dense, and will be of the nomadic-herdsman type except in mining centers. Hunting and trapping for furs will continue to produce some wealth, and local areas of denser population may grow up about slaughtering centers or mines.

PROBLEMS

1. Can the Prairie Plains Region surpass the North Central Section of the United States in agricultural development?
2. What will be the permanent type of agricultural development in the Prairie Plains Region?

3. Will the proposed Great Lakes-St. Lawrence Seaway be of greater benefit to both the Prairie Plains and St. Lawrence Lowland Regions than to any other region of North America?

4. Can the Arctic Meadows of Canada maintain as many people as now live in British Columbia?

5. Will the Arctic Meadows ever produce as much meat as the Prairie Plains?

6. Can manufacturing become an important industry in the Prairie Plains Region?

7. Will the development of irrigation make Alberta as productive as California?

8. Can the Prairie Plains Region maintain a population as large as that of the St. Lawrence Lowland?

CHAPTER 24

The Pacific Mountain Region

The Pacific Mountain Region is a vast, mountainous mass whose snow-capped and glacier-clad peaks rise above a vast forest wilderness that extends downward into its deep valleys and plateaulike areas. It is the highest and most rugged part of Canada, many summits reaching a height of 10,000 feet and a few exceeding 16,000 feet, the highest being Mount Logan, 19,540 feet. The coast is characterized by long, deep, narrow, well-sheltered indentations or fiords, extending far inland, giving the region more harbors than can ever be utilized for the development of commercial centers. Some of these indentations are continued into the highland beyond, as ravines or glens. Others are too deep for good anchorage, have too narrow and winding entrances for safe and easy passage of ocean vessels, or are too difficult to reach from the interior, while a majority have too precipitous and rugged surroundings for the development of important commercial cities. In addition, Vancouver Island shuts off nearly half the coast from direct connection with the open sea. The coast is also fringed by islands separted by deep channels, forming an "inside passage" through which ships may sail for nearly 800 miles protected ~~from the~~ winds and storms of the Pacific.

In general the mountain masses trend north and south in three rather distinct ranges—Coast Mountains, Selkirk-Cariboo-Stikine Ranges and the Rocky Mountains. Between the first two lies a broad, dissected interior plateau, and the Rocky Mountain Trench lies between the second and third. This mountain and trench structure, as well as altitude and ruggedness, has had a profound influence upon the climate, distribution, and character of vegetation, and on man's occupancy of the region and utilization of its resources. Only a very small part of the region is suitable for agriculture. The north-south trend of isotherms (Fig. 259) and the east-west variation in rainfall, conforming closely with topography, are striking features. Climatic zones likewise trend north and south (Fig. 9). The prevailing Westerlies bring mild oceanic temperatures and heavy winter rainfall to the Pacific Coast, and the western slopes of the mountains are clothed with a dense forest in which the Douglas fir is the most valuable tree. In descending to the interior plateau the winds give only scant rainfall, and temperatures are higher in summer and lower in winter than on the coast. However, as these winds again rise over the mountains of the interior and the Rockies, rainfall occurs on their western slopes, and forests prevail. The mean rainfall at New Westminster on the Fraser Delta is 55.12 inches; at Penticton, in the Okanagon Valley of the interior, it is only 10.85 inches; and at Lethbridge, in the rainshadow of the Rockies, 15 inches (Figs. 259 and 260). The interior plateau is semiarid and has a typical semiarid type of vegetation. Where ditch irrigation has been developed in the interior excellent fruit crops thrive. Large areas of hay and feed-crop lands are irrigated by flooding on many of the stock ranches.

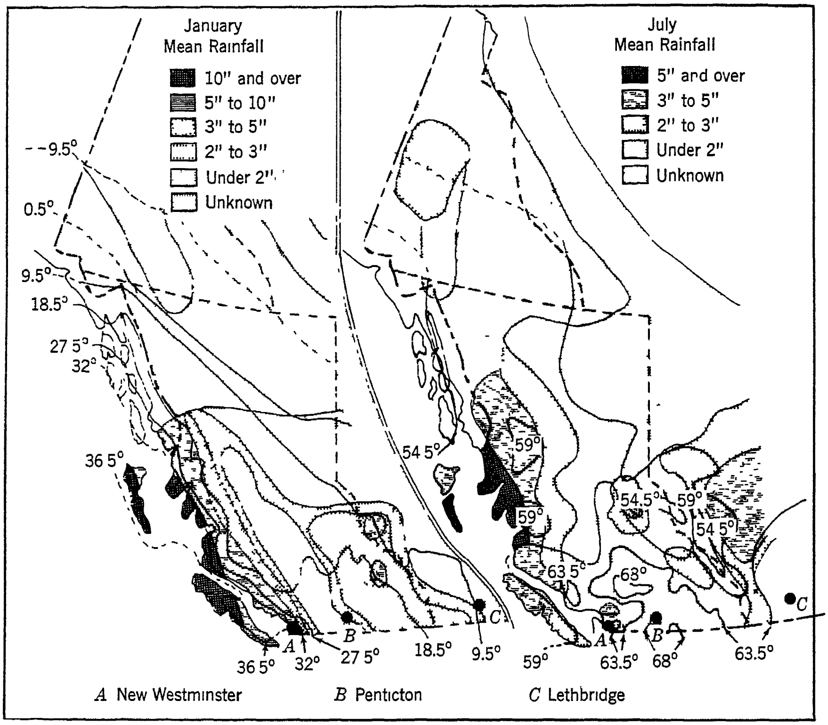


Fig. 259. Distribution of temperature and rainfall in the Pacific Mountain region.

¶The Fraser, Yukon, Skeena, and Stikine are the most important river systems. Though some of the rivers and the associated lakes are navigable for limited distances, most of the streams are characterized by numerous rapids and falls, which give the region a potential water power of nearly

11,000,000 hp, only 917,000 of which has been utilized thus far. The water-power reserve, plus the coal reserve, provides one essential for the development of manufactures which is likely to meet all probable future demands.

The population of about 1,100,000 is confined almost exclusively to the southern part and particularly to the southwestern coast, where fully three-fifths lives in the lower Fraser Valley and Delta. The two large cities are Vancouver and New Westminster, but there are scores of small villages and towns. The southwest is also the most densely settled farming area. Some 8000 people in the Yukon mining district, 7000 in the port of Prince Rupert, and a few distributed along railway routes are the exceptions. More than half the people are in cities and villages; the remainder are scattered among the lumber and mining camps, or are engaged in agriculture and stock raising along the valleys or over the grasslands. Since 1940 the population has increased about 25,000 a year, a rate of growth larger than that of any other section of Canada. This growth has been chiefly in the southern district on the lowlands along the lower sec-

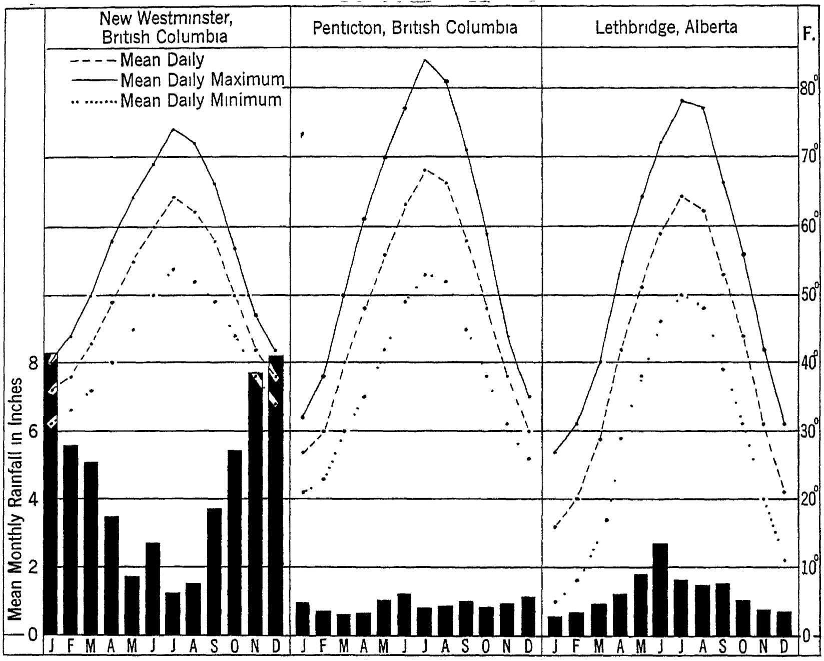


Fig. 260 Temperature and rainfall at stations across southern British Columbia. New Westminster is on the coast, Penticton is in the interior and Lethbridge in the rain-shadow of the Rockies.

tion of the Fraser River. Fully seven-tenths of the population are of British stock and most of the remainder of European origin. The demand for laborers, the opportunities offered in the fisheries, lumber camps, industrial and mining centers, intensive agriculture and horticulture, and accessibility by sea encourage immigration.

Forest Industries. The Pacific Mountain Region is a land of forests except on the far northern Arctic slope. These forests are almost entirely softwoods and contain much of the finest timber available in North America. The distribution of forest-, waste-, and arable land is shown in Table XXV. Estimates indicate that more than 200,000 square miles are suitable only for the production of timber. With only about 6 per cent of the land area of British Columbia arable, more than three-fifths of which is forested, it is clear that the future of the region depends very largely on the timber that can be produced. The climate and soil are excellent for forest growth. Measured by quantity it is estimated that nearly a fifth of the accessible, merchantable, standing timber of Canada is in British Columbia. It is believed that, without drain upon the growth, the annual cut can be 8,000,000,000 board feet, which is much larger than the present cut. However, proper conservation methods, reforestation, and protection from fire and insects must be enforced.

TABLE XXV

British Columbia Forest and Arable Land

	Merchantable (square miles)	Young Growth (square miles)	Total Productive (square miles)	Total Unproductive (square miles)	Waste and Arable	Percentage of Land Area Forested
Softwood	35,400	50,490	85,890	128,560		59.6
Waste land					137,163	38.1
Arable land						
Forested					13,034	3.6*
Non-forested					7,666	2.1

* Included in 59.6

Data computed from *Canada Yearbook*, 1949, p. 29

The Douglas Fir Coast District and the Interior Wet Belt are the leading lumber-producing districts. The Douglas Fir Coast District, with its heavy precipitation, high humidity, long growing season, and high average temperature with absence of extremes, produces a coniferous forest which is equaled for rapidity of growth, density, and acre yield only along the Washington and Oregon coasts. Much of the timber cut along or near the indented mainland coast and on Vancouver Island is brought to tidewater, where it is made into huge rafts and towed to sawmills located on some convenient harbor. Areas of mature trees yield 10,000–

100,000 board feet of lumber an acre, and average 20,000 feet. Douglas fir is the most important commercial type.

The climate of the Interior Wet Belt resembles that of both the coast and dry belts, with a comparatively humid atmosphere, a precipitation of 30–40 inches; a relatively long growing season, considering the high latitude and altitude; warm summers; cold winters, free from long periods of extreme low temperatures; and heavy snowfall, which assures an abundance of spring moisture. This region has a dense, rapidly growing forest cover, giving a large acre yield though not equal to that of the Douglas Fir Coast District. Cedar, hemlock, Douglas fir, spruce, and lodgepole pine thrive throughout most of the Interior Wet Belt, and western white pine occurs in the watersheds of the West Thompson and Columbia Rivers. Though second in commercial importance to the Coast District, this district may even excel the lumber possibilities of the Coast District because of its large area of potential forest land, which is now covered with young trees.

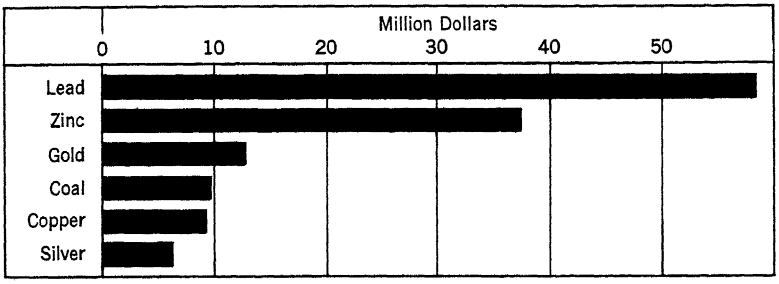


Fig. 261. Leading minerals of the Pacific Mountain region. More than four-fifths of the minerals produced are metals, with lead and zinc supplying more than three-fifths.

The most important commercial trees of the Pacific Mountain Region are the Douglas fir, used for lumber and other structural purposes, mine timbers, ties, and paving blocks; red cedar, the most important Canadian wood, for shingles; Alaskan pine or western hemlock, used extensively for structural and pulp purposes; and Sitka spruce and Engelmann's spruce, which are especially valuable for airplanes and pulp manufacture.

Lumber, shingles, and lath are the leading forest products, and British Columbia produces more than 45 per cent of the sawmill products of the country. In addition this region produces about 7 per cent of the paper. The Prairie Plains Region was for many years the principal lumber market, but exports now go to Europe by way of the Panama Canal, to South Africa, and to many other wood-consuming countries.

Mining. The mining district is a continuation of the Cordillera of South America, Mexico, and the United States. This mountain area con-

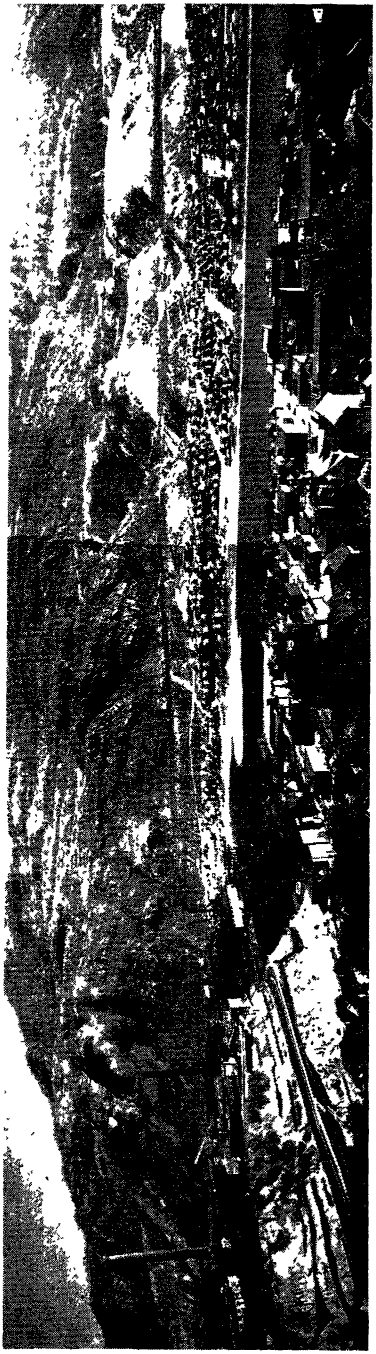


Fig. 262 The smelter at Trail on the Columbia River. *Photo by Miller.*

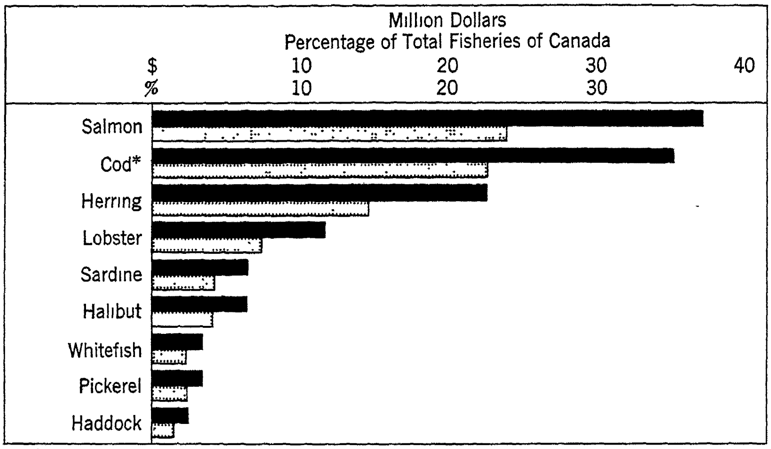
tains mineral wealth throughout its length. Coal was discovered in 1835, but the first mine, at Nanaimo, was not opened until 1851 and it has been worked ever since. Gold was discovered in the later 1850's, and the Fraser River rush began in 1858. In 1861 the Cariboo district was entered by prospectors, and the Williams and Lightning Creek districts were discovered. The Cassiar district was opened in 1873, and prospectors entered the Yukon before 1880. Klondike mining began in 1894, and the Yukon district reached its peak in 1900 with a gold production of $22,000,000. The early crude methods of mining in the Yukon have given place to large dredges, and many of the early tailings are being reworked. The development of lode mining, which is now much more important than placer mining, followed railroad construction in southern British Columbia in the late 1890's. Lode mining is now carried on principally between the Thompson River and the United States boundary. The principal mining camps are near the southern boundary of British Columbia at Kimberley, Slocan, Nelson, Trail, Hedley, and Copper Mountain; in the Dawson-Mayo district in Yukon; along the coast at Brittania Beach; and at Zeballos on Vancouver Island. Other important metal-producing districts farther north in British Columbia include Bralorne, Bakerville, Fort St. James, Hazelton, and Premier.

The region is noted for its lead, zinc, coal, gold, silver, and copper. It produces 98 per cent of Canada's output of lead; 58 per cent of the zinc; and nearly half the silver. The six minerals listed in Fig. 261 make up nearly nine-tenths of the total mineral production of the region. The Sullivan lead-zinc-silver mine near Kimberly, with an ore body about 200 feet thick, yields 90 per cent of the total lead. The ore is crushed and concentrated in the vicinity of the mine and shipped to the smelter at Trail (Fig. 262), which is the largest in Canada. A chemical plant utilizes the sulfur in the production of sulfuric acid and fertilizers. Silver, as in other parts of the Dominion, is derived from ore mined chiefly for other metals, especially lead and zinc. Such districts as Cariboo, Kootenay, Hedley, and Zeballos are noted for gold, and Brittania Beach and Copper Mountain for copper. Tungsten comes from Yukon and southern British Columbia, and the Pinchi Lake district produces mercury. With vast areas yet to be examined carefully, and the probability of finding more rich mineral deposits, it seems likely that the people of the region will find the production of minerals one of the most profitable occupations for many years to come.

The major areas of bituminous coal mining are near Fernie, in southeastern British Columbia, and Nanaimo, Comax, and Suquash on Vancouver Island. Small amounts of coal are mined at several other locations. British Columbia coal is the best steam and coking variety on the Pacific

Coast of the Americas, with the possible exception of Alaska; hence it has great significance for domestic manufacturing and mining, and land- and ocean-transportation purposes. It has practically no competition in the market at the present time. The probable reserve of British Columbia is about 19 per cent of the total probable reserves of the Dominion. The coal is chiefly bituminous and anthracite, with a relatively small proportion of lignite. The Yukon coal is largely lignite, but there is more than a hundred million tons of bituminous.

In addition to fuel the region has excellent water power available. The estimated resource, at mean 6-month flow, is 11,000,000 hp, making it rank second to Quebec. The installed capacity is 917,000, leaving an enormous reserve for future use in the development of its forest, mining, manufacturing, and transportation industries. Yukon, at the north, also has several hundred thousand horsepower, only a small part of which has been utilized.



*Includes Newfoundland exports only

Fig. 263. Principal commercial fish of Canada.

Fisheries. The Pacific Coast, with its deep fiords and estuaries, and a sea ledge extending 50–100 miles from the coast, offers excellent feeding grounds for fish. Fishing was carried on in the region by the Hudson Bay Company before settlement began, but canning on a large scale started in 1873. Today the region ranks next to the Maritime Provinces (Fig. 231) in fisheries, the annual value being 38 per cent of that for the Dominion. The industry is built primarily upon the habits of the sockeye salmon, which spawns in British Columbia streams, particularly the Fraser River and its connecting lakes; the fingerling spends the first year of its life in these fresh waters. The following three years are spent in the ocean. It returns in the fourth year to spawn, entering the rivers from June to September, the run being at its height from the last of July to the middle of August. The catch is being made when the fish are entering these streams, as they die after spawning. Because of the life habits of the salmon, every fourth year usually produces a large catch. The sockeye salmon weighs 3–10 pounds and is noted for its fine quality and color. The quinnat is a much larger variety of salmon, weighing 18–30 and occasionally 100 pounds. It enters the Fraser in the spring, and the run continues through July. The cohoe is about the same size as the sockeye and runs in the Fraser in September and October after the sockeye salmon run is over. The salmon is the principal one fished in Canada, but probably would rank next to cod if comparable data for cod were available (Fig. 263).

In entering the Fraser River the salmon pass through many miles of United States waters were a large part of the salmon catch is taken by United States fishermen. This situation raises an international question and a grave problem of conservation. The catch during the 3 years of minimum run depletes the supply and, since the fish spawn in Canadian streams only, conservation can be accomplished only by cooperation between the Canadian and the United States governments. Fortunately, this cooperation has been successfully carried out. The principal salmon centers are the Fraser, Nass, and Skeena Rivers.

Attention has been directed to other fish, particularly the halibut. The principal halibut fisheries are on the banks of the Queen Charlotte Islands, from which the catch is taken to Prince Rupert and shipped frozen to the United States and eastern Canadian markets. The northern or Yukon fisheries are small compared with those in the southern part of the region. The chief foreign markets for Pacific fisheries are Great Britain and other European countries, where a large part of the catch is sold.

Agriculture. Measured by gross annual value, agriculture ranks third as a producer of raw materials, with forests and minerals first and second, respectively. Development of agriculture, however, is greatly restricted, owing to the rugged topography, the problem of clearing the land for crop production, and the greater immediate opportunities presented by lumbering, mining, and fishing. The first farming took place in the Fraser Lake district in 1811. The fur-trading companies were the early agricultural pioneers. The Hudson Bay Company had a large farm near Fort Vancouver as early as 1837, producing grain, vegetables, and other crops, and raising livestock. This company also had large farms at Cowlitz and Nisqually, and smaller ones on Vancouver Island. The gold rush to the Cariboos in the 1850's and the establishment of mining camps supplied a market for agriculture produce, gave an impetus to farming, and accounted for the beginning of stock raising in the Nicola and Thompson valleys.

Though agriculture is confined chiefly to the south, the average value of field crops exceeds $33,000,000, and that of livestock on farms and ranches $37,000,000. Hay and forage, wheat, oats, rye, and potatoes are the leading field crops (Fig. 264). Cattle make up nearly three-fourths of the value of livestock and are produced for both meat and dairy purposes. The dairy industry has been growing, and the value of milk production alone now exceeds $17,800,000.

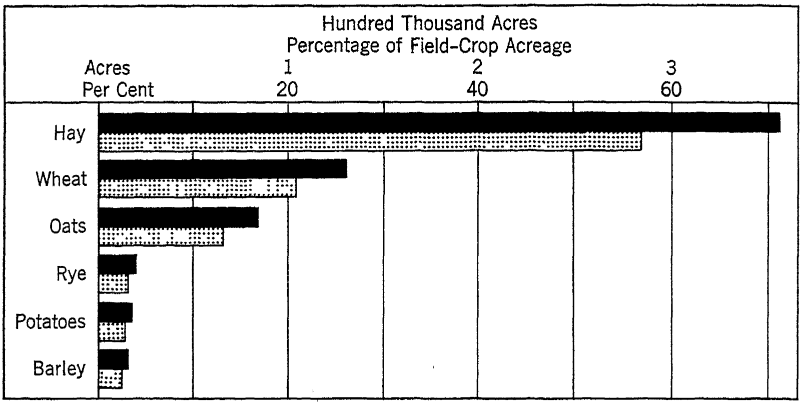


Fig. 264. Leading crops of British Columbia. These six crops occupy 98.8 per cent of the land in field crops. The region has less than 1000 square miles of land in field crops.

A considerable portion of British Columbia has both soil and climate suitable for growing fruits. Especially is this true in the long southern interior valleys, which have mild winters, and where fruit growing has made rapid progress. The tree fruits include apples, pears, peaches, plums, and apricots; and the small fruits include strawberries, currants, and raspberries. British Columbia now produces more than half the commercial fruit of the Dominion. Okanagan Valley, lower Fraser Valley, Kootenay-Arrow Lakes section, and Vancouver Island are the principal fruit regions. Okanagan Valley is indeed, a "land of fruit." More than 33,900 acres are irrigated out of an irrigable area of 36,140 acres in organized irrigation enterprises. The mountain highlands present a sun-dried, drab appearance in summer, but the deep-green orchards of the valley form a striking contrast where water from mountain streams has been carried to the alluvial areas by ditches. Kelowna and Penticton are important fruit centers. Penticton stands on a delta built across the valley, with Okanagan Lake on the north and Dog Lake on the south (Fig. 265). Here is a Canadian "Interlaken," but without the grandeur of mountain scenery that surrounds its Swiss counterpart. Its life centers around the growing, canning, packing, and shipping of fruit. A nearby mine also contributes to its activities. It is served by one east-west railroad, and by another which reaches it from the north by car ferries on Okanagan Lake.

Owing to the mountainous and plateau character at the south, the mountain and climatic limitations at the north, and limited markets, the land at present devoted to field crops is only about 627,000 acres, more than half of which produce hay and forage crops. The cultivated land is confined almost exclusively to the warm southern valleys, terraces, deltas, and flood plains. The farms, unlike those of other parts of Canada, are small, usually not more than 25–30 acres, and are cultivated intensively. In addition to cropland, approximately 100,000 acres is used as range pasture. Estimates indicate that 4,225,000 acres are suitable for tillage, and a total of 14,528,000 for some form of agricultural use, and this is only about 6 per cent of the land area of British Columbia, but it is highly improbable that more than a small fraction of this potential acreage will be utilized for many generations to come.

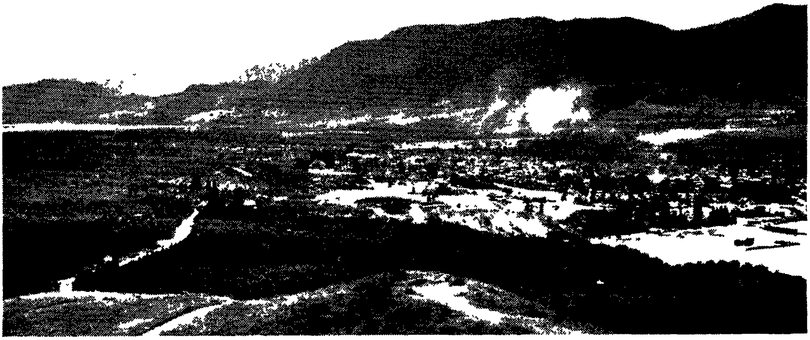


Fig. 265 Penticton in the Okanagan Valley and part of its irrigated orchards. *Photo by Miller.*

Manufacturing. The Pacific Mountain Region was a frontier wilderness when the factory system of production was established in the East. Manufacturing in British Columbia never passed through the usual slow evolutionary stages from domestic handicrafts, into small work shops, introduction of a small amount of machinery and tools of precision, and thence into large factories with many employees, producing for universal markets, as occurred in the older settled sections of the country. When the time for manufacturing came British Columbia was ready to start with the factory system. The coming of railroads was the first important transforming event, as these gave connection with the interior. But the real development of manufacturing began with the opening of the Panama Canal in 1914 and the stimulus of World War I. As an alternative to the long trip around Cape Horn or the long and costly transcontinental route to European markets, the Canal was a great boon to the region. In 1910 the product value of manufactures was $65,000,000 and there were 33,300 employees; in 1920 the figures were $237,000,000

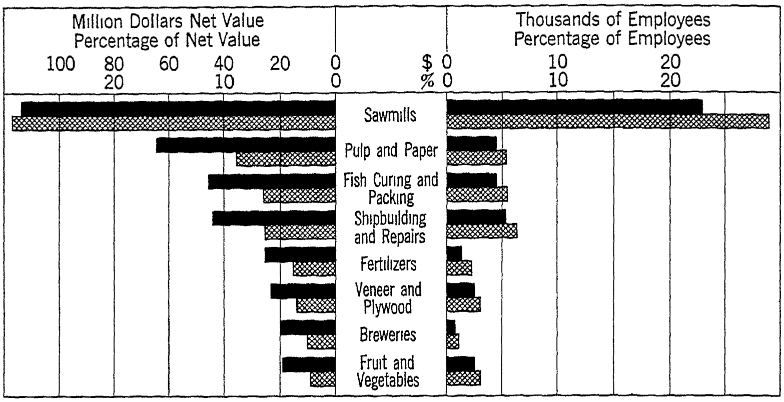


Fig. 266. Leading manufacturing industries of British Columbia. Forest industries account for more than two-fifths of the manufacturing.

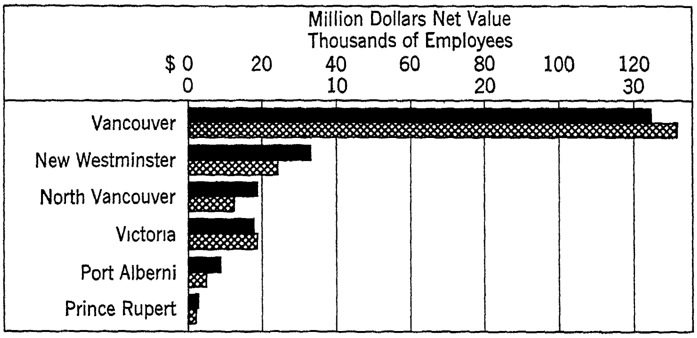


Fig. 267. Leading manufacturing cities of the Pacific Mountain region. More than half the manufacturing of the region is on the delta of the Fraser.

and 35,100; in 1929, $276,000,000 and 51,300; and in 1948, $985,000,000 and 86,600, respectively.

The industries that have thrived are those based upon the abundant natural resources of the region. The dominant ones utilize the splendid forest resources and make up more than two-fifths of the total net value of the manufactures of the region. Next in rank is fish curing and packing, followed by shipbuilding (Fig. 266). Shipbuilding gained first place during World War II, and, even though it has declined greatly since its peak year in 1943, it ranks second in the number of people employed. British Columbia has abundant resources of raw materials, coal, and water power, good railroad facilities to the Prairie Plains, and a water route, open all the year, to the markets of the world.

Cities. All the large cities are along the southwestern mainland coast and the southeastern coast of Vancouver Island (Fig. 267). Here are located Vancouver (Fig. 268), Victoria, Port Alberni, New Westminster, North Vancouver, Nanaimo, and numerous smaller cities. Prince Rupert, 500 miles north of this group, is the only other important coastal city. Near the southern border, along the railways, is a series of several minor cities among which may be mentioned Nelson, Kamloops, Vernon, Kelowna, and Cranbrook.

Vancouver is the most important; it is the third city in size in Canada and the largest city west of the St. Lawrence Lowland. In 1880 its site was a wilderness. When the Canadian Pacific Railway selected it for a terminus, growth was stimulated, and since about 1910 its population has increased from 29,000 to 275,000. This is a remarkable growth when one considers that Vancouver faces the Pacific, with its back to the rest of the Dominion, and is separated from it by many miles of forested mountain country. It has a fine, natural, ice-free harbor capable of accommodating all shipping that it is ever likely to have; oceanic connections with the United States, Alaska, the Orient, Australasia, and Europe, by way of the Panama Canal; a near hinterland that contains most of the population of the region and produces agricultural crops, livestock, and forest and mineral products. It is also economically accessible to the products and markets of the Prairie Plains; is near existing and probable future oceanic trade routes; is close to the populated centers of western United States and western Canada; is the entrepôt for British Columbia; is the center of the lumber industry; and the Vancouver metropolitan district produces more than half the manufactures of the province. As the markets for the products of agriculture, forest, and mines are Atlantic and southern Pacific points, its geographical advantages are greater than those of any more northerly Pacific port and seem to assure its prosperity as a commercial and industrial center. Its growth as a commercial port has been striking, and it now ranks with Montreal, Toronto, and Quebec as one of Canada's leading ports. With the exception of harbor superiority, the same factors affecting Vancouver may be said to apply to the neighboring towns in the district, including New Westminster and North Vancouver.

The capital city, Victoria, situated on the southern end of Vancouver Island, is primarily residential, and only a seventh the size of Vancouver. However, it ranks fourth in manufactures. It faces the state of Washington, whose mountains rise 7000 or 8000 feet from the sea, presenting a beautiful spectacle from the city. It was originally settled by British immigrants who came across the Isthmus of Central America and north along the coast by ship, and Victoria has retained much of its English appearance and spirit. Victoria's harbor is too shallow for the larger vessels, and its island location, separated from the mainland, limits its commercial and industrial development and possibilities. Only the southern end of Vancouver Island about Victoria may be considered as cleared and populated, the balance being a rugged, timber-clad highland.

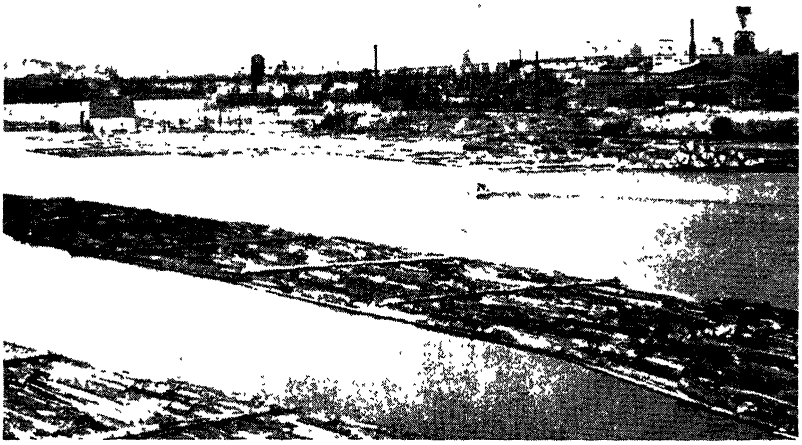


Fig. 268. Part of Vancouver Harbor, Canada's principal Pacific port. Huge log rafts may be seen floating in the harbor. *Photo by Miller.*

Prince Rupert was established as a Pacific terminus of the Grand Trunk Railway system. Though smaller than several other cities it is of special interest because it is spoken of as the future rival of Vancouver. It is the terminus and shortest route from eastern Canada to oriental ports north of Shanghai, and has an excellent harbor with a wide, direct, and short entrance to the open ocean, and ample suitable space for the growth of a city. It is also nearest the best agricultural section of the western prairie, but the present transportation routes by way of Yellowhead Pass make these sections nearer to Vancouver, and they have better grades. Its hinterland for 150 miles inland is a rugged, forest-covered area with small agricultural value, as it is near the northern limit of cultivable crops. The trees are smaller, of less commercial value, and fewer to the acre than farther south, and the region is not known to be rich in minerals. Probably its best opportunity for import trade is the development of the fresh-fish traffic from adjacent and Alaskan waters to the markets of the United States and Canada. However, such trade is not likely to produce a large city. Prince Rupert now ranks sixth among the manufacturing cities of British Columbia, and its principal industries include lumber mills, fish canneries, grain elevators, and cold-storage facilities.

PROBLEMS

1. The Pacific Mountain Region of Canada has possibilities for development as great as the Pacific states of the United States.

2. The Pacific Mountain Region offers more favorable and varied conditions as a permanent home for man than the Prairie Plains Region.

3 Will the Pacific Mountain and Prairie Plains Regions, taken as a unit, become the most productive and most important portion of Canada?

4. Will Vancouver become the leading commercial and manufacturing city on the Pacific Coast of North America?

5. What will be the two leading industries of the Pacific Mountain Region?

6. Can the Pacific Mountain Region maintain a population greater than the Rocky Mountain and Plateau states of the United States?

7. The highest development of the Pacific Mountain Region can come only by the unrestricted admission of oriental peoples.

8. Are the food-producing possibilities of the Pacific Mountain Region equal to those of Washington and Oregon?

PART IV

Mexico and Middle America

CHAPTER 25

Mexico

SOME MAJOR CONSIDERATIONS

The Effects of Physical Contrasts in Mexico. The nature of the physical environment is reflected well in the government of Mexico. If nations are to be governed effectively and economically, and if they are to have the currents of national life flow with serenity and force, they should consist of natural environmental units or groups of closely knit units. Canada lacks such unity in its natural environment, and Mexico exceeds Canada in this respect. Mexico consists of a broad tableland, two coastal plains, and two peninsulas. The tableland occupies the central portion and is sometimes called the Mexican or Anahuac Plateau, on which more than one-half of the country's people live. Bordering the plateau are mountain barriers, known as the Sierra Madre Occidental and Sierra Madre Oriental, which separate the plateau from the coastal slopes, where about one-third of the people live. Yucatan and Lower California are peninsulas, more closely associated with the United States commercially than with the remainder of Mexico, being separated by either tropical forest, desert, or large bodies of water. Further, the Highland of Chiapas lying to the east of the Isthmus of Tehuantepec is also isolated.

Contrasts of these physical divisions are further accentuated by differences in altitude and in climate. The low, flat plain of Yucatan is scarcely above sea level whereas the Mexican Plateau lies at 8000 feet, with numerous peaks 15,000–17,000 feet in elevation. One may stand amid tropical plants on the coastal plains at Veracruz and gaze on permanent fields of snow capping Mount Orizaba 75 miles away. The annual precipitation varies from more than 150 inches on the Gulf slope of the high land in southern Mexico to as little as 3 inches in the Colorado Delta. Mexico is, therefore, a land of contrasts and extremes, and lacking in geographic unity.

Climatically, four temperature zones are sometimes recognized in Mexico: *Tierra Caliente, Tierra Templada, Tierra Fria,* and *Tierra Heladas,* the hot, temperate, cold, and snow-capped, respectively. Their boundaries are rather indefinite because of differences in latitude, precipitation, and direction of extent of mountain ranges and coasts, and one may find *Caliente* enclaves at *Templada* altitudes, and vice versa. The *Tierra Caliente* region is low and hot, having a temperature range mainly between 68° and 110°, and lies generally below 3000 feet. *Tierra Templada* is the temperate region and lies approximately between 3000 and 6000 feet, being higher in the south than in the north. *Tierra Fria* lies above 6000 feet and thus includes much of the plateau and the surrounding highlands. *Tierra Heladas* is the permanently snow-capped and frozen land on the higher peaks and ridges. (Compare these regions with the temperature and climatic regions discussed in Chapter 1.)

In the seasonal distribution of rainfall there is some uniformity in the various regions. The northwestern part of Mexico lies for the most part south of the subtropical, high-pressure area of the Pacific, and, except in the extreme northwest, it is in the belt of the Northeast Trades, which in the American mediterranean region blow from almost due east. Eastward-facing slopes, i.e., windward slopes, receive a good supply of rain, and lee slopes are comparatively dry. Summer is the rainy season in Mexico. The northward shifting of the equatorial belt of calms with doldrum rains brings rain on slope, plain, and plateau. But since the Trades are also blowing, more rain falls on eastward-facing slopes than on the level or nearly level areas.

In the matter of rainfall, the west coast presents a strong contrast to the east. On the west coast, as far south as 22°–24° N., the prevailing winds for the year are from the northwest, from the Pacific High, and are therefore dry. This portion of Mexico is thus a continuation of the desert and semidesert of southern California and Arizona.

South of 22°–24° N., southwest winds in summer, similar to the southwest *Monsoons* in India, move into the low pressure over the plateau and give a light rainfall to the southwest-facing slopes of the Sierra del Sur and the Mexican Plateau. The surface of the great Plateau of Mexico, bordered on the east, south, and west by higher lands, thus has only a meager rain supply. At Mexico City, now known officially as Mexico, D.F. (Distrito Federal), the year's supply is only about 25 inches, falling mostly between May and October, inclusive; and at the northern border of the country the precipitation is only 8–10 inches, with the rainy season mainly in July, August, and September. The northern and northwestern parts of Mexico have not only the lowest rainfall but also the shortest rainy season. Most of Mexico north of 22°–24° N. has less than 20 inches of rainfall, and about a third of this area has less than 10 inches.

On the moist lowlands of the *Tierra Caliente,* conditions are suitable for tropical forest and the production of tropical crops. Humid temperate-zone forests and crops may be grown on the coastal slopes of the plateau, on the slopes of the mountain ranges, and on the plateau itself where water is available either from rain or through irrigation. Over a large part of Mexico, in the semiarid section, the pastoral industry will continue to dominate in man's use of the land.

The lack of unity in climate, natural vegetation, and crops would make for strength in some countries, inasmuch as some regions or groups are complementary to others (the arid are complements of the humid; the highlands of the lowlands; the temperate of the tropical), but the isolation of the various parts, the results of topography or location, prevents the country from reaping the advantages of these complementary conditions.

The Great Importance of Railways in Unifying Mexico. In the physically disjointed lands that make up Canada many thousands of miles of railroads have been necessary to bind together into a fairly unified nation these contrasting geographic units. In Mexico the plateau and the east coast, together with the Isthmus of Tehuantepec, are fairly well connected by railroads. The northwest coast has rather poor railway connections with the plateau. The southern Pacific from Nogales, Arizona, runs southward along the desert coast by way of Guaymas, Mazatlan, and Guadalajara to Mexico, D.F. Short branch lines from this railroad serve the mining regions on the western slopes of the Sierra Madre Occidental, but no connections are made with the lines on the Mexican Plateau. Lower California and the Colorado Delta have practically no railroads. Yucatan has railroads serving its northwestern portion and much of its interior, but these lines make no connections with other railways of the country as a whole. Mexico has no large and navigable rivers that facilitate commerce. A few of its rivers are navigable in the lower courses, but contact with the sea is generally made difficult by sandbars, and great variations in depth and flow. The railroad is, therefore, all important in Mexico as in Canada in holding together the various geographic regions (Fig. 269).

Railroad construction meets with great engineering difficulties, particularly within and on the borders of the Volcanic Plateau on which Mexico, D.F., is located. In passing from one basin to another 4000–5000 feet above the sea, the railroads are in many cases forced to ascend to altitudes of 8000 feet or more. Mexico, D.F., had no rail connections with its chief port, Veracruz, until 1873 because of political conditions involved, and because of the engineering difficulty of reaching the 8200-foot elevation of the plateau.

Mexico, D.F., is the logical railroad center of the country and will, in time, when the railway network is extended, have close contacts with all sections. But at present Yucatan, Chiapas Plateau, Lower California,

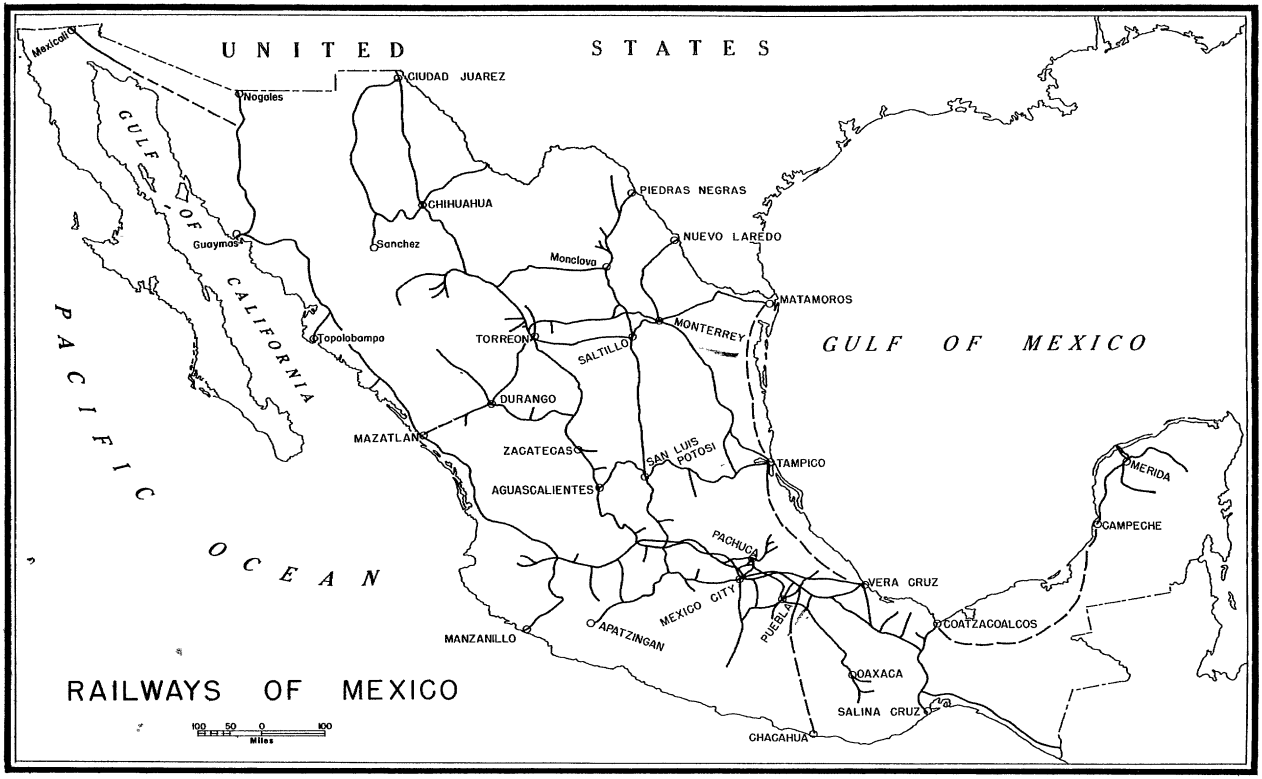


Fig. 269. Important railroads of Mexico. Note the congestion of lines in the vicinity of Mexico, D F., the most important railroad center of the country.

the Colorado Delta, and much of the northwest coast are isolated from the capital city. A large part of northern Mexico is commercially tributary to the United States, for many railway lines cross the border, as at Brownsville, Laredo, Eagle Pass, El Paso, Nogales, and Presidio.

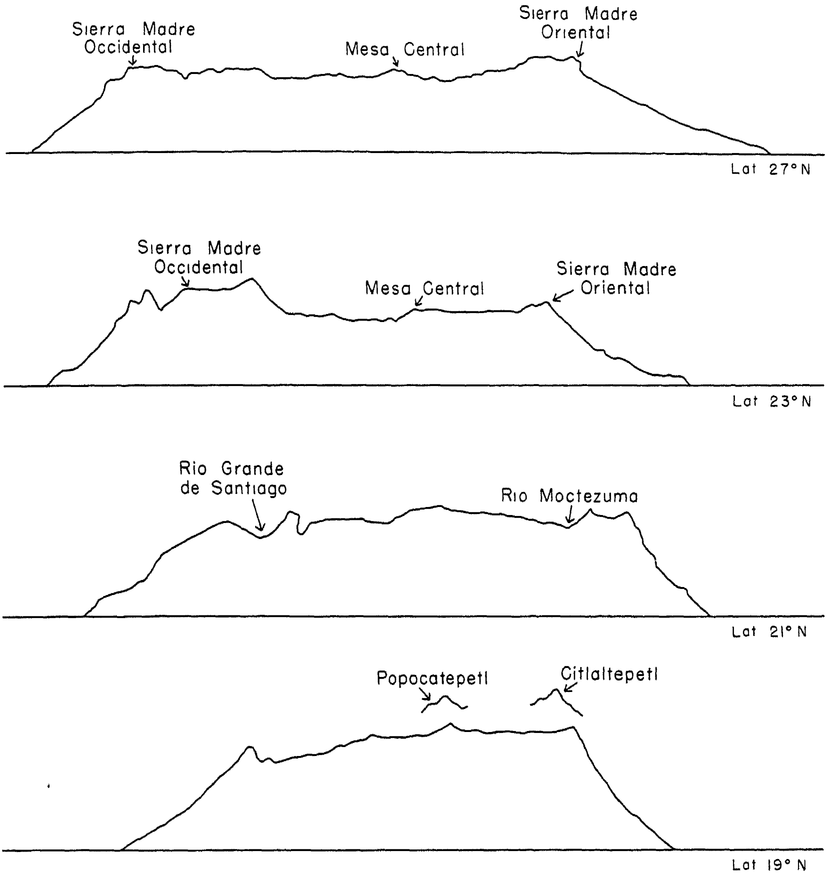


Fig 270. Cross-sections at various latitudes, showing the Central Plateau and bordering Sierras of Mexico, narrowing and increasing in elevation towards the south.

Another feature of the railway net in Mexico is that there are few branch lines. This leaves many sections located far from the influence of the railway, and, since highways are often unimproved trails, and many people are poor, the donkey is the common beast of burden.

The Influence of the Spanish Ruling Class. In Mexico there is a wide gulf between the ruling class and the common people. The ruling class is mainly of Spanish descent or nearly so, and number only about 1 in 13 of the total population of approximately 25,000,000. Full-blooded Indians number about 1 to 4, and the large group remaining are mestizos or mixed Spanish and Indian. During most of Mexican history the minority ruling class has owned most of the land, in great holdings known as haciendas, whereas the mestizo and Indian groups have been virtual slaves on the land, kept in poverty and ignorance, and having no part in the government. Attempts at land reform were made in 1915, and since that date the large holdings have been expropriated and lands redistributed. The large feudal estate is gone. Now there exists considerable private property, but there are also many community holdings known as the "ejido" (to be discussed later). There still exists a wide cultural and economic gap between the minority upper class and the remainder of the people, a fact of major importance in any attempt to study the geography of a country.

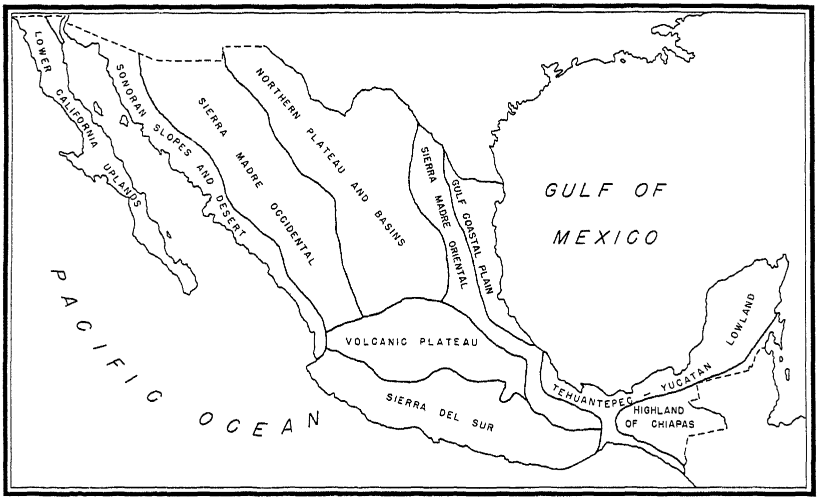


Fig. 271. The physiographic regions of Mexico.

PHYSIOGRAPHIC PROVINCES OF MEXICO

Because of the diverse nature of its physical environment, and the lack of a unified culture in its people, it is convenient to continue our study of Mexico by recognizing its major physiographic provinces and making an attempt thereby to localize and interpret the diverse human activities and cultural landscapes of the country.

Mexico consists of a peninsulalike southeastward extension of the Rocky Mountain Cordillera of Canada and the United States, curving and narrowing toward the Isthmus of Tehuantepec (Fig. 270). Its shape has been likened to that of a horn with the blunt apex located at the Isthmus. The form of the land is mainly that of a broad central plateau bordered by Sierras that increase in elevation and converge in a wild scramble of volcanic mountains toward the southeast. To the west and the east, the Sierras slope toward the Pacific and the Gulf of Mexico, respectively, forming narrow coastal plains. The isolated peninsulas of Lower California in the northwest and of Yucatan in the southeast complete the area of Mexico. Physiographically (Fig. 271), Mexico may be considered to be made up of the following provinces:[1]

1. Northern Plateau and Basins
2. Sierra Madre Occidental
3. Sonoran Slopes and Desert
4. Lower California Uplands
5. Sierra Madre Oriental
6. Gulf Coastal Plain
7. Volcanic Plateau
8. Sierra del Sur
9. Tehuantepec-Yucatan Lowland
10. Highlands of Chiapas

The Northern Plateau and Basins. This province consists of a large, semiarid upland extending southeastward from the Colorado Plateau and the upper Rio Grande, bordered on either side by the Sierras, and ending at the south where the great knot of mountains forms the Volcanic Plateau. Sometimes this entire central upland is referred to as the Mexican Plateau, but in this study we distinguish the Northern Plateau and Basins from the Volcanic Plateau on the basis of structure. As we shall see later, the Volcanic Plateau consists of higher and much dissected volcanic land with a general east-west trend, whereas the Northern Plateau and Basins is a broad, semidesert area, trending largely north-south, with a drainage which loses itself in the bolsons[2] and playa lakes of the interior. Numerous mountains of uptilted rocks, forming ranges, feature the Plateau and Basins province, which has less of the lava formations in evidence, than are found in the Volcanic Plateau.

The surface of the Northern Plateau and Basins has an elevation of 3000 or 4000 feet on the United States border, but rises toward the south to 8000 feet. Though not a plain, the topography is subdued, with many filled basins and broad waste slopes. The bedrock is composed mostly of lava sheets laid down on old crystalline rocks. Sedimentary rocks occur in places and indicate a time when a part of the plateau lay beneath the level of the sea. Much of the bedrock of this province is mantled by aeolian, alluvial, and lacustrine deposits; the soils derived from these need only water to yield abundant crops. At the time of the rainy season, streams flow toward the interior, filling the numerous shallow basins to form lakes. During the dry seasons the lakes disappear, leaving broad

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[1] Modified from W. N. Thayer, *Jour. of Geology, XXIV,* 1946.

[2] *Bolson*—a shallow, closed basin containing an ephemeral lake; a Spanish word means "purse."

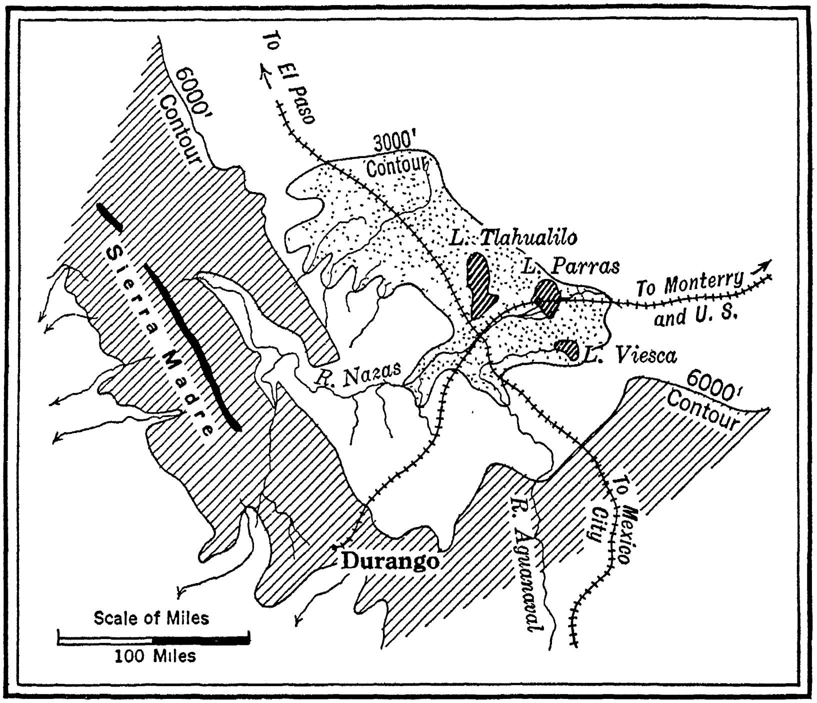

Fig. 272. The laguna region on the Northern Plateau of Mexico. This basin is in many respects like Carson Sink in western Nevada. The lakes vary greatly in height during the year. Irrigated lands bordering the streams produce a good quantity of cotton.

stretches of mud, salt, and alkali. These playas and salinas are numbered by the hundreds, but only a few are large enough to be represented on our small-scale maps. Three of the largest of these lakes lie in the vicinity of Torreon, and are fed by the rivers Nazas and Aguanaval, some of the water from which, in the rainy season, is diverted to vast fields of wheat and cotton. In this basin alone is produced about 60 per cent of Mexico's cotton crop. The Nazas, about 370 miles long, is called the Mexican Nile, and the lake district the Laguna (Fig. 272).

In the northern part of the Plateau and Basins province, one finds physical conditions similar to those that prevail in western Texas and southern New Mexico; yet what a contrast in the human occupants of the environment! In crossing the Rio Grande a person from the United States passes into a truly foreign country. The enterprise, progress, and aggressiveness that characterize the people of the United States are left behind. From the twentieth-century type of civilization of that country in which man has gone a long way toward conquering nature, one plunges into a land where man is only in the beginning of his cultural development. The difference lies not in the physical environment but chiefly in the difference in the human stock and government. There are untold treasures of mineral wealth beneath the surface in Mexico, and some of these deposits have been exploited for centuries; yet these riches have gone to benefit the few, while the vast majority of the people have remained in poverty and ignorance, unacquainted with the great progress that is being made in other parts of the Americas, in Europe, and the distant continents.

Aridity has found its response in a landscape that is characterized by scattered bits of vegetation and brightly colored soils and rocks; in adobe huts and pretentious, whitewashed dwellings of mud and clay; in frequent insurrections led by "generals," each with a few hundred half-starved, lawless, nomadic followers; in large estates; and in a sparse population. The chief wealth of the plateau, as previously stated, lies in the immense mineral resources that have for centuries been exploited and yet, relatively speaking have hardly been touched. Gold and silver are widely distributed and are mined in almost all the states of the Mexican Plateau. There are known deposits of copper, tin, cinnabar, and sulfur. The bituminous coal field of the state of Coahuila, an extension of the lignite field of Texas, is actively worked in Mexico, and from it comes nearly all the coal consumed in the country. The annual output in times of peace is about 800,000 to 1,000,000 tons. Near Durango is a famous hill of iron ore, Cerro de Mercado (640 feet high, 1100 feet wide, and 4800 feet long) which contains, it is estimated, 460,000,000 tons of high-grade ore. There are metallurgical works, smelters, and reduction plants for the preparation of metals for export in the several cities of the plateau. Monterey has a large iron and steel plant, and two iron and brass foundries. Although there are possibilities of much greater pastoral and agricultural development, one must not overestimate the soil resources, for aridity is greater here than in parts of the United States where the rainfall is the same, because evaporation is greater. Besides the cotton of the Laguna, wheat, corn, ixtle fiber, and maguey are the chief crops.

United States capital has invaded the Northern Plateau and Basins province, and has been invested in mines, forests, and lands. In this region the largest of the haciendas—the great landed estates—were found. Some included thousands of acres, numerous villages, and as many as 2000 people. The pattern of population distribution throughout most of the Northern Plateau and Basins province is one of many centers of density along drainage lines where moisture is available for cropping, at springs, or at irrigation centers, but with wide areas of sparse settlement between.

The Sierra Madre Occidental. At the western edge of the Northern Plateau and Basins province lies the Sierra Madre Occidental, which forms a formidable barrier toward the Gulf of California. It includes a belt of elongated plateaus and mountain ranges varying from 50 to 100 miles in width and stretching from Arizona southeastward to the Volcanic Plateau in about latitude 21° N. The crests of this mountainous structure are mainly lava plateaus lying from 1000 to 2500 feet higher than the basins to the east. Numerous streams serrate the edges of these plateaus, and the result is very rough surfaces with deep canyons both to the east and to the west. These streams dwindle in volume after leaving the mountains, and most of them disappear to the east in the basins, and to the west on the desert slopes before reaching the Gulf of California.

The mineral wealth of the Sierra Madre Occidental is closely associated with the geologic history of this province. Ancient lava flows served to enrich the mountains with veins of gold, silver, copper, lead, and other metallic ores. These have been mined to a limited extent since the Spanish conquest. Erosion has laid bare much of this mineral wealth on the slopes of the Sierra Madre, and here, also, the rainfall is sufficient to support some forests of pine, oak, and cedar interspersed with grassland. Thus there is a timber supply for construction in the mines, and a water supply for mining camps, towns, and for irrigation in the lower valleys and arid plains on either side of the western Sierras.

Because of the roughness of the surface, the Sierra Madre Occidental is thinly populated, and is one of the least known parts of Mexico. No railroads cross from central Mexico to the Pacific. Indian tribes in the Sierra Madre escaped contacts with the conquering Spaniards, and to this day have few contacts with Mexican life.

The Sonoran Slopes and Desert. Lying immediately to the west of the Sierra Madre Occidental province and occupying the slopes and the narrow coastal plain together with the Colorado Delta is the province which may be named the Sonoran Desert and Slopes. It faces the shallow Gulf of California and extends from California and Arizona southeastward to the Rio Grande de Santiago. Numerous streams rise in the high Sierra and cascade towards the Gulf, but many are lost in the sands of the narrow coastal plain, and thus never reach the Gulf. Particularly is this true towards the north, where, for a distance of 300 miles south of the Colorado, streams seldom reach the coast. Farther south the bordering Sierras are higher, and the rainfall is greater, thus providing some drainage which reaches the Gulf and the Pacific Ocean at all times.

The delta plains of the Colorado have very low rainfall, but irrigation is possible. United States capital is developing this section for the raising of long-staple cotton, alfalfa, and barley. Many enterprises are managed from the United States side of the boundary, and the products find their chief market in the United States. The non-irrigated lands are owned by Mexican cattlemen, and, but for the enterprise of United States people in developing irrigation, all the lands would be devoted to grazing.

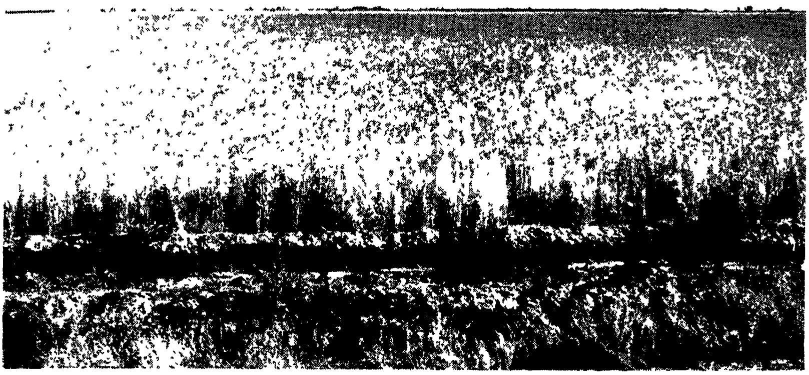

Fig. 273 Wheat field in the Valle del Yaqui on the west coast of Sonora. There is considerable interest in the development of irrigation in Sonora. Here the climate is arid, but water exists in the ground of all the area immediately to the west of the Sierra Madre Occidental. A pump irrigation system supplies the water for the field of wheat shown in this photograph Note the uncleared desert vegetation in the background. *Photograph from Rockefeller Foundation Agricultural Program for Mexico.*

The section from Nogales to Guaymas is also arid, but irrigation is possible because of the large supply of water from streams coming from the higher Sierras, where the rainfall is 30 inches or more. Lack of capital and management, and a ready market has so far hindered any great development (Fig. 273).

Guaymas, although little more than a village, is the port for the state of Sonora. Far back in the 1860's, it had prospects of being of considerable commercial importance, being the Pacific terminus of one of the projected transcontinental lines of the United States. A railway was built from the Arizona border at Nogales southward along this coast, but Guaymas did not develop as a great port, though the railway reached it. This railway has been extended southeastward along the coastal plain, finally reaching Mexico, D.F., by way of Guadalajara. Several ports developed along this arid coast, such as Topolobampo and Mazatlan.

To the south of Guaymas, conditions similar to those of the state of Sonora prevail, although the rivers carry more water than those farther north, the result of higher mountains and heavier rainfall in the mountain areas and on the coastal plain. There are many prosperous irrigated areas on the several broad plains.

In the Fuerte Valley some companies have developed excellent sugar plantations with their own modern centrals or factories. There can be little hope for success, however, in the production of crops that must compete with those raised in the southern and southwestern United States as long as these crops must surmount a protective tariff barrier at the international boundary. Then, too, the home market in Mexico is not great. Yet, except for this, there are excellent opportunities for future expansion. The principal crops are chick peas, wheat, and rice. The culture of rice is being developed on a large scale. Chick peas, most of which are exported to Spain and Cuba, are an important crop.

Grazing is the dominant industry at present. In the past, fame of these states has rested on their mineral deposits, and the same will undoubtedly be true in the future. Indeed, it is claimed by some writers that this region is the richest in minerals in the world. Its gold helped fill the coffers of Spain even in the early colonial period. The traveler in regions distant from the railroad will find many old workings and tailings along the streams leading out of the canyons, some 1000 feet deep, that pierce the lofty western Sierra even to the old rocks that form the core of the Plateau of Mexico. These old rocks over most of the plateau, enriched by volcanic intrusions which brought deposits of gold, silver, copper, and lead, are buried deep by lava intrusions and riverine and lacustrine deposits, and are most easily reached at the edges of the plateau in these "shafts" carved by nature. This region is the Mexican Eldorado for United States capitalists interested in the exploitation of precious and semiprecious deposits; but the difficulty of transportation to the sea coast, or even to the railroad near the coast, has greatly reduced the profits and resulted in wasteful mining and smelting, the baser metals often being neglected. Gold, silver, and copper crushers and smelters are located near the workings, the "pigs" or bars being packed by mules or burros, 100 miles or more in many cases, to the railroad. Besides the metallic minerals, graphite of an excellent quality is mined near La Colorado, Sonora. Oil is known to be present in great quantities, and prospecting has hardly begun. The extensive beds of anthracite in Sonora, including some seams 12 or more feet thick, are pierced by only a few mines.

The Lower California Uplands. This physiographic province known as Baja California territory is the most isolated in all of Mexico. It consists of a peninsula 50 to 150 miles wide and about 750 miles long, formed by a continuation of the Coast Range mountains of California. It is separated from the mainland of Mexico by the long and narrow Gulf of California. Much of the Lower California upland has an elevation of 4000 to 6000 feet, and the coastal plains are narrow and non-existent. In an overland journey from California to the southern tip of the peninsula, a journey replete with hardships and delays, for highways are poor, one views a series of landscapes of barren hills, desert plains, and rocky mountains, with here and there an irrigated valley. The upper slopes of the mountains are clad with thin forests of oak and pine. Wheat is grown in some of the northern valleys by Russian colonists; and in the far south Chinese gardeners and horticulturists, only a few hundred in number in all, raise vegetables and subtropical and tropical fruits. About 80 per cent of the people live in the southern portion of the peninsula, chiefly because of the greater rainfall in this section.

Yet Lower California is not without resources which, if developed, would support a population many times the present 95,000 people. There is some timber on the mountain slopes, economically inacessible at present, and valuable fisheries of pearl shells and edible fish. The interior, only partially explored geologically, is known to contain rich deposits of copper, silver, lead, zinc, and gold, and immense amounts of iron ore. The most productive copper mine, about the only mineral development in the peninsula, is owned by a French company at Santa Rosalie, which not only mines the ore but also smelts it. Development of these mineral and forest resources awaits better transportation facilities. The coastwise traffic is now mostly in the hands of United States people. United States merchants on the Pacific Coast furnish most of the imports of machinery, mine supplies, groceries, dry goods, gasoline, and kerosene; and a railroad, should one be built to penetrate far into the peninsula, must naturally come from the United States. Lower California is, therefore, bound to be absorbed by the great Republic on the north, perhaps not politically (several advances have been made toward its purchase), but commercially, and this has already been accomplished to some extent.

The Sierra Madre Oriental. The Sierra Madre Oriental is a narrow belt of mountains bordering the Plateau and Basins province on the east, and extending from the Rio Grande southeastward to Oaxaca and the Sierra del Sur. Like the Plateau and Basins province, it increases in altitude towards the south. Only a small portion is higher than the inland plateau, and for this reason the Sierra Madre Oriental is sometimes considered as being only the eroded edge of that inland province, sloping eastward to the coastal plain. This eastern Sierra is not so high as its western counterpart, and it is composed mainly of folded limestones. Due to the abundance of rainfall the slopes are rounded, quite heavily forested, and form a less formidable barrier than the Sierra Madre Occidental.

The topography is mature, and the numerous valleys have a fertile soil produced from the limestones. Coupled with high temperatures and abundant rainfall, this province favors agriculture where the slopes are not too steep. The forested slopes furnish timber and charcoal, charcoal being the fuel in general use for the household, though oil is now replacing charcoal to some extent. Water power is abundant in the province, but it is not developed extensively except in the Orizaba region where it is utilized in the textile mills.

The Gulf Coastal Plain. The Gulf Coastal Plain is a continuation of the Coastal Plain of Texas, and, like that plain, is composed chiefly of sands, and is bordered on the east by lagoons and barrier beaches. It is crossed by numerous rivers that descend from the slopes of the Sierra Madre Oriental. In their lower courses, the rivers are, for the most part, aggrading streams. The Coastal Plain is approximately 150 miles wide along the Rio Grande at the north. Toward the south it narrows, and ends where the mountains nearly approach the Gulf, just north of Veracruz. The Sierra Madre Oriental is less a barrier at the north than at the south. In northeastern Mexico the mountainous border of the Northern Plateau and Basins province breaks down to the north of Saltillo, and railroads cross the lower courses of the Rio Grande to reach the plateau cities by easy grades. From Tampico, the great oil-exporting port, railways extend to Monterrey, San Luis Potosi, and other cities. The Coastal Plain is largely outside the belt of tropical rains, and, although the rainfall is ample, its distribution is irregular. Toward the southern end the rainfall is heavier, and tropical vegetation appears. Considerable cotton, sugar, bananas, rubber, and rice are grown on the coastal plain, and great possibilities for future development of agriculture exist, though, on the whole, little has yet been done. The chief commercial interest at present centers about the petroleum district of Tampico and Tuxpan.

The Volcanic Plateau. In central Mexico the great mountain ranges of the Sierra Madre Occidental and Oriental increase in elevation southward and converge in a wild scramble of volcanic mountains, basins, deep gorges, and ridges to form the Volcanic Plateau, commonly called the Mexican Plateau. It has an average elevation of about 8000 feet and differs from the Northern Plateau and Basins in that it has a general east-west extent instead of north-south, and it is chiefly volcanic in origin, although diastrophism has undoubtedly been active (Fig. 274). It stretches westward from the Sierra Madre Oriental near Veracruz practically to the Pacific where the deep gorge of the Rio Santiago brings it to an end. Evidences of vulcanism on a grand scale, even within the last 2–3000 years, were revealed by archeological studies near Mexico, D.F. There has been partially uncovered here a "Mexican Pompeii" buried in volcanic mud and ashes. Gases are still exuding from some of the volcanic mountains, and bare scoriaceous lava fields exist in some parts.

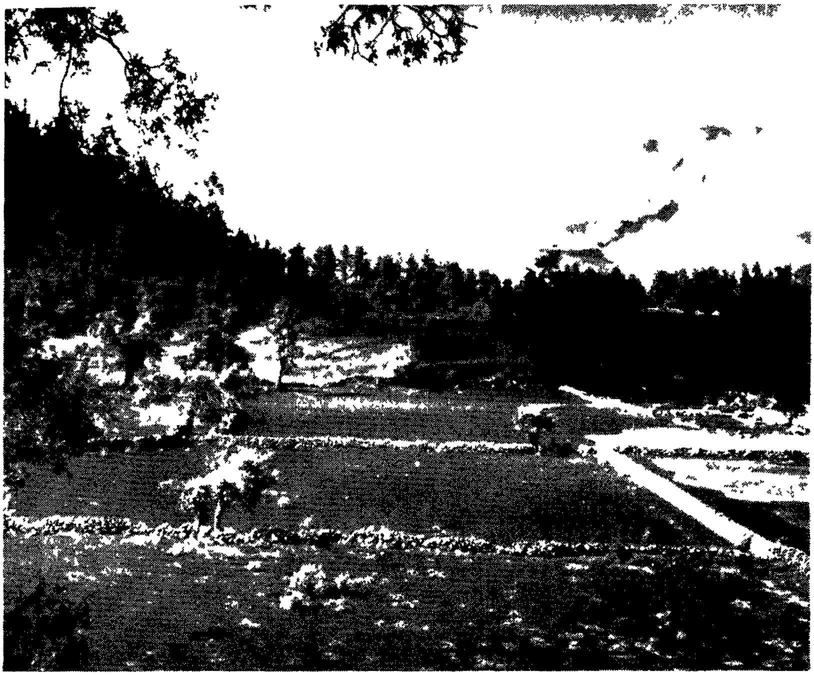

Fig. 274. Paricutin Volcano, Mexico. *Photo by R. T. Hatt, Cranbrook Institute of Science* Though Popocatapetl Volcano is Mexico's most widely known, the most recent is Paricutin, in activity in 1944. Seen from the town (distance of 6 miles) of Angahuan one here looks into the crater. The fields about are covered with a heavy blanket of black ash. The hill slope at the left is the base of extinct volcano. The forest is mostly pine. Stone fences are largely made of volcanic bombs and lava from nearby volcanoes.

Veracruz is the port most commonly used by travelers to reach the Volcanic Plateau, the most densely populated part of Mexico. Here live about 50 per cent of the people of Mexico, although the area is about 10 per cent of the total of the country. Here are the most populous cities of the country and the most populous states. The states are smaller than in other parts of Mexico, and the land holdings smaller. This is the most attractive part of Mexico from the standpoint of temperature. Although the rainfall is not so great as farther south, it comes in the summer, and is sufficient for the development of large rivers, such as the Santiago and its tributaries. The Rio Santiago has in its middle course the largest lake of Mexico, Lake Chapala, 70 miles long and 20 miles wide in places. These rivers have cut deep gorges on the slopes of the Volcanic Plateau. They supply power to numerous factories, and some have hydroelectric plants supplying light and power to the cities. In nearly every valley, water is used for irrigation. Only a beginning has been made in the utilization of the water resources of the Volcanic Plateau and the bordering slopes.

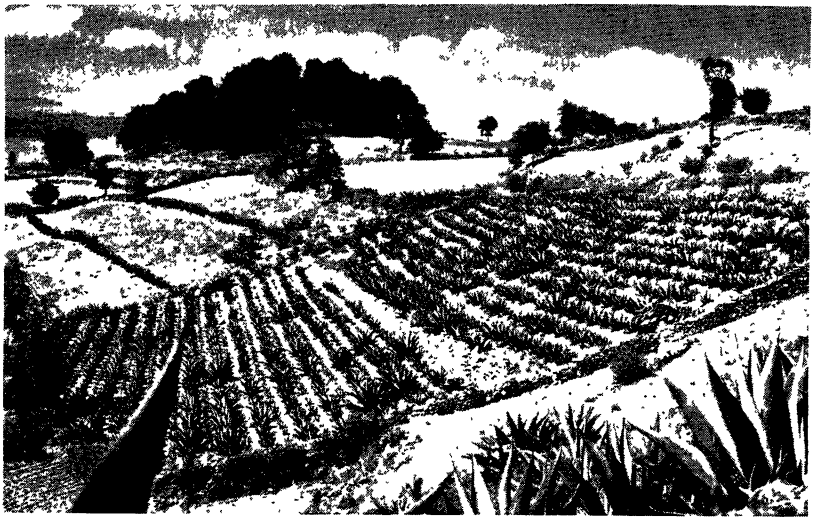

Fig. 275. A maguey crop on a hillside in the volcanic plateau region south of Mexico, D.F. This crop is used both for pulque and fiber production. *Courtesy, Rockefeller Foundation Agricultural Program.*

The Volcanic Plateau is one of great topographic diversity, and this results in a diversity of climatic conditions. Above the plateau which is in the *always mild* temperature region, rise the lofty volcanic mountains, Popocatepetl (17,881 feet), Orizaba (18,206 feet), and others, and below are many basins and gorgelike valleys. Oak and pine form forests on the lower and middle slopes of the mountains. On the plateau surface are great fields of beans, vegetables, maguey (Fig. 275), and cereals; and in the basins and valleys the irrigated lands are given over to corn, sugar cane, and tobacco. Coffee is grown on the well-drained slopes, and pasture lands are widespread.

Mexico, D.F., is the crowning glory of the cities of the country, and vies with, and in some respects even surpasses, the cities of Anglo America. Like other Hispanic capitals, it has numerous expensive government buildings and wonderful cathedrals, characterized by beautiful architectural lines, maze of detail, and solidarity of structure. The city lies in a beautiful basin some 40 miles long and 30 miles wide, which contains 6 withering lakes. In pre-Columbian days the city was on an island, connected to the mainland by a causeway, and all the lakes of the basin were larger (Figs. 276 and 277). In the conquest of the city in 1522, Cortez destroyed every block of buildings; but in the rebuilding the Aztec plan of the city was followed, the causeway became a roadway, the center of the ancient city became the plaza, and a huge cathedral was built on the

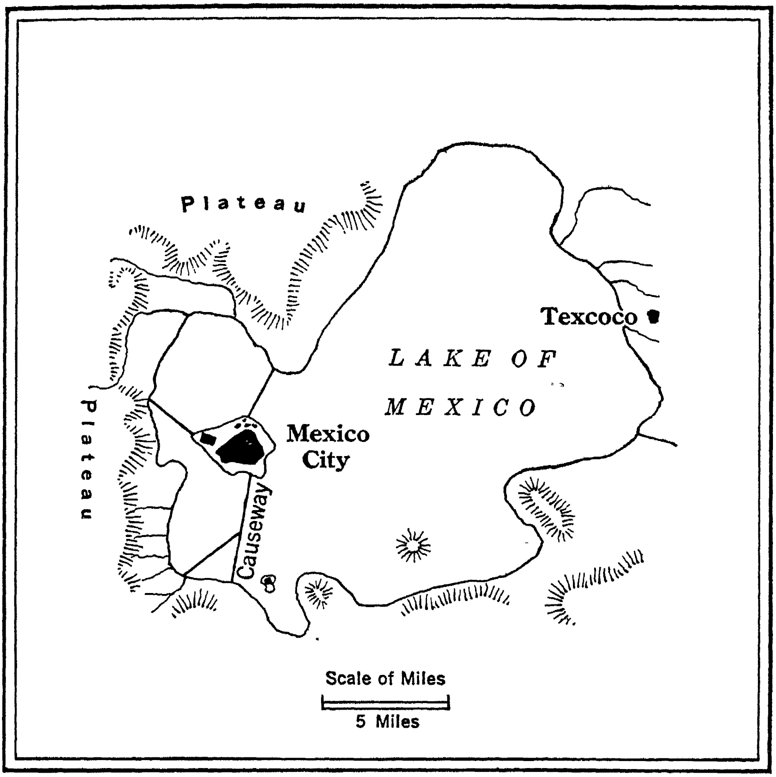

Fig. 276. Mexico City about 1519 The city at this time, located on an island about 3 miles from the western shore of Lake Texcoco, also called Lake of Mexico, had a population of about 300,000. It was connected to the mainland by several well-built causeways.

site of the temple where human sacrifices had once been offered by the hundreds and thousands.

Mexico, D. F., has a population of 2,942,000 (1950) and is the center of Mexican civilization in all its aspects. To the other cities, villages, and communities in all parts of the country, it is a political and social center. Its shops contain goods from every manufacturing country in Europe, as well as from the United States. It is the most cosmopolitan of Mexican cities. Its numerous ecclesiastical buildings and temples and institutions of learning make it a great religious and educational center. If its influence fails to be felt in the most isolated part of the country, it is because of the great physical barriers and the low economic and social status of many of the Mexican people.

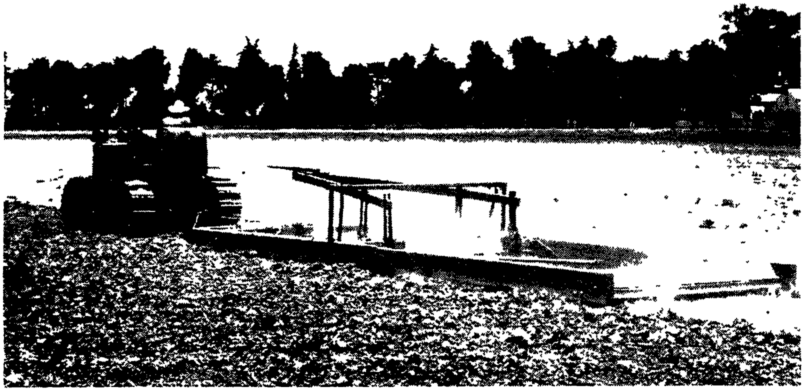

Fig 277 Cultivation for crops on the old level lake bed of Texcoco, at Chapingo near Mexico, D.F. Industrial plants have been located elsewhere on this old lake bed to make use of the salts in the manufacture of potash and caustic soda. Also, the site of the airport is on this lake bed. *Courtesy, Rockefeller Foundation Agricultural Program.*

The Sierra del Sur. The slope from the Volcanic Plateau southward to the Pacific is the most dissected province of Mexico, and is referred to as the Sierra del Sur. It extends from the Rio Santiago eastward and ends in the State of Oaxaca in a steep escarpment overlooking the Isthmus of Tehuantepec. Much of the superficial volcanic material has been removed by the rivers that drain this slope. Remnants of erosion stand out as peaks whose summits are about equal to that of the Llanos of the Volcanic Plateau to the north.

In a cross section of the Sierra del Sur, from the Pacific to the Volcanic Plateau, one finds a variation in climatic conditions, natural vegetation, and crops similar to that of the eastern slope from Veracruz to the Volcanic Plateau. The coastal plain bordering the Pacific is narrow, yet in its 700 mile length there are valuable forests of cedar, mahogany, and other woods, for this section is well watered. Plantations growing sugar cane, cacao, coconuts, rubber, rice, fruits, and fiber, although widely scattered, indicate the possibilities of the section in tropical agriculture. At higher altitudes the vegetation and crops approach in character those of the Volcanic Plateau. The irrigated valleys are particularly productive. Agriculture is the chief reliance of the people, although there is much grazing, timber cutting, and mining. Immense deposits of minerals are known to exist, and scientific exploration has hardly begun. The inaccessibility of this section from the Volcanic Plateau and the dense vegetation are undoubtedly reasons that the world knows so little of the mineral resources here. The entire slope will have a great future when it becomes more densely settled and more railroads are provided. In the lowlands of Mexico, however, the Indian has never been disciplined in persistent labor. This region would have many of the possibilities of northern Italy, if it were properly worked.

The Tehuantepec-Yucatan Lowland. Beginning at the narrow Gulf Coastal Plain just north of Veracruz and extending southward and eastward the Coastal Lowland broadens and continues, to include all of Yucatan and a considerable strip across the Isthmus of Tehuantepec that widens along the Pacific Coast. This is the Tehuantepec-Yucatan Lowland, which differs in a number of respects from the Gulf Coastal Plain to the north. The Tehuantepec-Yucatan Lowland is bordered on the west by the Sierra del Sur and the volcanic slopes of the Sierra Madre Oriental, and toward the southeast by the Highland of Chiapas. In general this province consists of low-lying fertile plains sloping gently seaward. Its elevation is mostly under 2000 feet. Mangrove swamps and lagoons are characteristic of the Gulf margin, with the exception of northern Yucatan which is semiarid, due to lack of rivers in a land of porous limestones, and to less rainfall. Considerable development of plantation agriculture is found for some distance south of Veracruz, in the truly *Tierra Caliente* lowland. Sugar, rubber, bananas, and rice are the chief crops, and the natural vegetation is luxuriant because this entire province, with the exception of northern Yucatan, lies in the tropical rain zone.

Yucatan peninsula, also tropical in temperature, is even less populous than that portion of the lowland just discussed. About 3.5 per cent of the people of the country live in the peninsula. The density of population of the State of Yucatan, the most populous part of the peninsula, is only about nine to the square mile.

Yucatan peninsula is the "Florida" of Mexico in its geologic structure and origin. It is a low, flat, calcereous plain, practically without rivers, the excess water finding the sea through underground channels. As in parts of Florida, there are numerous sinks and caverns, some 100 feet or more in depth. These caverns are the source of water supply for the people over a large part of the peninsula, and for that reason the small settlements are often found near these caverns or open sinks.

The drying winds of the *Trades* (practically all the rain comes from the occasional tropical cyclone) restrict the vegetation to a scanty growth in the north, but this vegetation increases in size and density toward the south. Near the base of the peninsula where the rainfall is heavier, there are tropical forests of great density with the characteristic epiphytes, lianas, and the broad-leaved evergreens. Most of the peninsula outside the forest is given over to grazing, but in northern Yucatan henequen is the leading crop. This part of the peninsula is closely knit commercially with the United States, for henequen is in great demand as binder twine in the grain fields of America.

The economic life of most of the people of northern Yucatan is built upon the henequen industry: the growing of the plant, the extraction of the fiber, its transportation, and its shipment. The bulk of the freight carried by the numerous railroads is henequen, and the hundreds of miles of tramways transport the long, fleshy leaves from the fields where the plant is grown in rows that stretch for long distances across the low, rolling or hummocky plains, to the railway stations from which it is taken to the factories. Merida is the political and commercial center of the State of Yucatan, but Progreso is the only important port. There is no harbor at Progreso, for the whole coastline, like the eastern coast of Florida, is bordered by lagoons, barrier islands, and shallow water. Ships receive and discharge cargoes from lighters.

The Highland of Chiapas. Eastward and southward from the Isthmus of Tehuantepec there rises a mountainous mass of folded sedimentary rocks and volcanic formations known as the Highland of Chiapas. It extends into Central America and increases in altitude towards the southeast. The Pacific slope rises to 9000 feet within 30 miles of the coast, and hence is very steep. The portion of this highland included in Mexico lies above tropical plains on either side and is very much isolated from the remainder of the country. It is, because of its altitude, about as well suited for higher cultural development as the Volcanic Plateau, and perhaps even better, because it has a more copious supply of rain. The density of population is about 13 to the square mile. Its greatest needs are people, roads, and railroads, and with these it has a grand future. The savannas are natural grazing grounds; the valleys may be irrigated; and the bordering tropical forests are as rich as any in the country.

CHAPTER 26

Mexico as a National State

Area and Population. One of the first considerations in determining the importance of a nation is the number of its people and the size of the area they accupy. However, great powers of the world are not necessarily those with the largest population and the greatest area. Culture, amount, and development of resources, foreign trade, standard of living, government, and numerous other factors enter in the problem of ranking a nation among the powers of the world, a fact which is well illustrated in the case of Mexico.

The Spanish possessions in North America once bordered the Gulf and the Caribbean on their north and east and included much of North America westward from the Mississippi. The Pacific Coast from 42° N. to the Isthmus of Panama was Spanish, and Spain held a hazy claim even to parts of the Alaskan Pacific littoral. The Mexico that won its independence from Spain in the early part of the nineteenth century included only a part of this vast domain; yet, for about two decades, it was among the six or seven great countries of the world in area. The loss of the northern territories to the United States and the secession of Guatemala reduced the area to 763,944 square miles. Mexico is still among the nine leading nations in surface extent. It is seventy times as large as Belgium, seven times as large as Italy, about three times as large as France, and has more than six times the area of the United Kingdom, including Ireland.

As in most of the countries of the New World, Mexico's population is not as large as it can really support. The average density is only about 32 to the square mile, and the total population about 25,000,000. This, however, is about 35 per cent more than the population of Argentina, 45 per cent more than Canada, and more than three times that of Sweden or Australia. With the exception of Brazil, Mexico is the most populous of the Latin American countries of the New World. On the basis of area and population, therefore, Mexico ranks well among the nations of the world.

In spite of this high ranking in area and population, Mexico is classed among the minor nations along with most of the countries of South

America. However, since about 1930 Mexico has gained in international good-will and respect.

Antiquity of Mexico. Some nations, like some individuals, claim recognition and homage because of the traditions and history that lie behind them. Surely Mexico should rank high in this respect. Archeological investigations in Mexico have convinced scientists that a people sufficiently advanced in their cultural development to construct great, rough, stone pyramids 100 feet high lived in the Valley of Mexico at least 3000 years ago. Their implements were very crude, consisting of flaked or chipped knives, bones, and scrapers, and roughly shaped pottery. These discoveries push American history back many centuries. Neither archeology nor history has yet been able to fix the date of man's coming to Mexico. As far as tradition goes, the country has always been inhabited. Certainly the southern part of the Mexican Plateau had been the center of an advanced civilization for many centuries before the Spanish came, and this civilization developed under conditions very similar to those of Egypt, Mesopotamia, and Central Asia, namely, isolation, limited area, healthfulness, high fertility of the soil, and irrigation. An equally old, and perhaps earlier, civilization thrived in the Yucatan peninsula, as archeological work has so clearly proved.

Legend and tradition fix the sixth century A.D. as the time when a group of Nahuas arrived in central Mexico. Toward the close of the seventh century a band of Toltecs, possibly descendants of this Nahua group, formed a settlement, the ruins of which are now known as Tula, about 50 miles north of Mexico, D.F. These early invaders were replaced by other tribes, yet Tula civilization dominated a large part of the plateau until the second half of the eleventh century. Some time after the year A.D. 1300, the Aztecs, also a branch of the Nahuas, appeared in the Valley of Mexico, looking for a "Promised Land" of which their deity had told them. They settled at many points in the valley, but about 1325 established themselves on an island amid the waters of Lake Texcoco. The insular position of the city gave its inhabitants protection.

The city grew rapidly; the Aztecs became powerful and expanded the frontiers of their country. Yet they were not the only people of advanced civilization that filled Mexico with palaces, temples, pyramids, and tombs, the ruins of which are a wonder of the modern world. Tradition fixes the third century A.D. as the time when the great Mayan tribe moved southward into Yucatan, a date even earlier than that of the genesis of the Toltecs and Aztecs. Archeology has much yet to decipher of the ancient civilization of Mexico. Evidences of its high development are numerous. The Toltecs worked in silver and gold, wove cotton, made pottery, cut stone, erected wonderful buildings, and on their walls left records in the form of picture writing. The splendor of the Aztec city of Mexico, which was the wonder of the conquering Spaniards, hardly surpassed the center of Toltec civilization.

The Aztecs left their records in hieroglyphics. In their primitive form of writing they drew maps of their country, left genealogies, and published their laws. They had a calendar of 18 months of 20 days each, with additional days each year. Leap years were allowed to accumulate, and every 52 years 12 to 14 days were added to the regular year. Among their artisans there were potters, paper makers, masons, and workers in metals. Placer deposits were worked, and silver was separated from the ore by chemical means. Gold was also separated by the amalgamation process. Cloth was made from cotton, palm, and cactus, and decorated with feathers. The Aztecs had aqueducts, reservoirs, suspension bridges, fortifications, and embankments. Other archeological exploration on the Mexican Plateaus has revealed pyramids and other public works antedating the Aztec remains. The glory of ancient Mexico is hardly less than that of ancient Egypt.

Mexico under Spain. As a Spanish colony, Mexico was one of the choicest of the New World possessions, and vied with Peru in yielding wealth to the Spanish Crown and court favorites.

The Spanish regime was fruitful in many respects. The first printing press in America was set up in Mexico about 1540. The second university founded in America was established in Mexico City about this time. The foundations of the Cathedral of Mexico, the beautiful structure still to be seen in the capital, were laid about 1575, and church architecture of this period has hardly been surpassed in America.

Attempts were made about this time to improve the health conditions of Mexico City by the excavation of a canal across the rim of the basin. Also, the church founded missions, and nobles and priests united in "uplifting the natives.'' Often their efforts were of little avail, for at times and in some sections slavery of the most brutal sort prevailed. Many of the Spanish Creoles of colonial days were wealthy and contributed much to the culture of the world.

Mexico under Diaz. For more than half a century after the War of Independence (proclaimed 1810, effected 1821), internal strife brought the fortunes of Mexico to a low ebb, to be rehabilitated under the masterful control of the dictator Diaz who ruled Mexico with an iron hand, and in some respects beneficently, from 1877 to 1911, with the exception of 4 years. No country ever made what seemed to be greater progress in the same period of time than Mexico during these 30 years. Diaz kept order throughout the whole land; foreigners could travel in safety anywhere. Mexican credit was good with any lending nation, for Diaz put the finances of his country on a firm basis. Harbor works were provided. He also formulated a far-reaching scheme to cover the land with a modern system of transportation and to that end increased the railway mileage during his regime from 367 miles to 15,000. At the time of his resignation there were nearly 40,000 miles of telegraph lines, 850 miles of federal telephone lines, 6 wireless offices, and 2974 post offices. Nearly 3000 vessels entered, and about the same number cleared, the ports of Mexico each year. Agriculture was prosperous, mines and factories busy, the banks were solvent, and hundreds of millions of dollars of foreign capital were invested in Mexican enterprises. Encouragement was given to schools and colleges, the effect of which reached the aristocracy but not the masses. The rule of Diaz showed the world what a dictator government could do, but at what a cost to the great number of people living in peonage!

THE RESOURCES OF MEXICO

The resources of the different divisions or regions of Mexico have been pointed out. Let us here summarize these assets that we may better see how they have served as the material basis of progress and well-being in Mexico.

Forest Lands. The forest lands of Mexico cover some 44,000,000 acres, of which about 25,000,000 acres are timber lands that have a wide variety of woods, as we have seen. The tropical forests bordering the coasts, from which come rubber, gums, and lumber, can be the more easily exploited because of nearness to the coast, but lumbering here as in most tropical regions is difficult, for the timber trees do not grow in close stands, and non-commercial trees and vines and undergrowth interfere with the operations of the lumberman. The ground is often soft, making the use of wheeled vehicles difficult, and the logs have a high specific gravity so that they are rafted only with difficulty. The exploitation of the wet tropical forests of Yucatan and elsewhere must await the building of railroads; and the temperate zone forests of the slopes of the interior mountains likewise will long be conserved because of their isolation, except those about mining properties which call for mine timbers. In spite of the difficulty of lumbering, the forest resources of the country are great and will be of great value in the timberless age that is fast coming in the United States and Europe. Importation into the United States has already begun.

Agricultural Lands. The extent of potential agricultural lands is difficult to estimate, for man in Mexico is just at the beginning of his evolution in land utilization. To what extent irrigation, dry farming, new crops, and scientific practices will expand the agricultural frontiers is impossible to determine. Some authorities state that there are about 37,000,000 acres of tillable land; only 13,400,000 acres are cultivated, an area almost equivalent to one-third of the state of Indiana. This is less than 5 per cent of the total area of the country. The United States had in 1945 over 18 per cent of its total land area in harvested crops.

The lack of suitable agricultural lands in Mexico is well shown by the climatology of the country. It is estimated that land rated as deficient in moisture throughout the year is nearly 50 per cent; that having no deficiency in moisture, 12.8 per cent; that having moisture deficiency in summer, only 1.4 per cent; and that deficient in moisture in winter, 35.9 per cent. In a country with such a large percentage of arid land one would expect irrigation to be an important practice. It is important, but the projects are relatively small. The total irrigated area is estimated to be not much over 5,000,000 acres, and this in a country of nearly 25,000,000 people. Five large irrigation projects were completed by 1934, and several times that number were under construction or have been completed since. Numerous small irrigated areas are found in all the provinces except the tropical coasts on the east and south. Large irrigation and dry-farming areas are the Laguna, the Imperial Valley, and others, but the most notable ones are along the Rio Grande and its tributary, the Rio Conchos. Opposite El Paso on the Rio Grande and extending some 30 miles downstream is an important Mexican cotton-growing area. This section has not prospered, because of decreasing waters in the river resulting from a larger take of the water on the United States side and upstream. The Rio Conchos, which is a tributary of the Rio Grande coming out of Mexico, has a number of irrigated areas along its course; these are devoted to cotton. A large dam, far upstream, regulates the flow of the water. Irrigation along the Rio Salado in Nuevo Leon, opposite Laredo, Texas, has not been very successful because of the alkali in the soil. There has been considerable difficulty between Texas and Mexico along the Rio Grande over water rights of the river. The volume is low, and it becomes a question of who has the right to divert water for irrigation.

One factor of great promise in Mexico is the wide variety of agricultural products, many of which could and do find a market in the United States: henequen, ixtle fiber, tobacco, India rubber, coffee, and various fruits. Yucatan now produces about one-half the world's crop of henequen. Though much is used at home, the market for this fiber is dominantly foreign, but there is little foreign ownership in the plantations. It will be noted that considerable of the products mentioned above are of the hot, moist lowlands and valleys, the sections of the country that have been little developed. In the exploitation of the moist tropics, the work of the twentieth century, Mexico has an opportunity to reap great benefits, provided the capital and technical knowledge can be forthcoming.

It is evident, therefore, that there are great opportunities in Mexico in agriculture, yet few of these have been exploited, and Mexico as a producer of commercial agricultural products falls below some of the other Latin American countries.

The Pastoral Industry. One of the reasons for the lack of development of the agricultural resources is the prominence of the pastoral industry and of mining. In the United States, as we have seen, the pastoral industry has been pushed out of the natural grazing lands of the Great Plains by agriculture or a combination of agriculture and grazing, and forced to the regions of greater aridity. In parts of Yucatan a similar economic movement has occurred, but, for reasons stated previously, it seems unlikely that there will be much shifting of industries in the semiarid sections of northern Mexico. According to some sources, there are 120,000,000 acres of grazing lands.

Stock raising in Mexico dates from the Spanish conquest and received much encouragement from the mother country. Mexican horses and cattle were the first to appropriate the grasslands of the Great Plains in the United States. Mexican horses were used by the Indians of the Great Plains, and white traders drove horses eastward from Texas to the United States frontier. Through neglect, poor pasturage, and scanty water supply, much of the stock in northern Mexico is poor in quality. Even though scrawny and small, the horses and cattle are tougher and longer lived than the livestock of the more humid lowlands in the south. Diseases spread by insect pests are more common in the humid regions. Yucatan is an exception, no doubt, because of the dry climate and the underground drainage.

Horses, mules, and donkeys are the transport animals in most parts of Mexico and, therefore, in demand. The general lack of good roads makes the ox-cart and the pack animal the means of transportation, away from the railways and major highways. Many mines maintain contact with the railroads by pack animals (Fig. 278).

Cheap lands and large-scale enterprise have made cattle raising profitable, even though the home market for beef is limited and the chief exports of the industry are hides and tallow. With more careful breeding of cattle, Mexico could find a large and profitable market for beef in the United States and Europe. This, however, calls for packing plants and control of disease. In the 1930's a good beginning was made in the beef-cattle and dairy industry in the plateau and southern basins, but the foot-and-mouth disease ended it. Exports to the United States have lately been resumed, but in general the great packing companies of the United States have overlooked the opportunities in Mexico or have decided that conditions are more favorable to their business in Argentina and Uruguay, 4000–5000 miles farther away.

Mining in Mexico. Mexico, no doubt, is one of the greatest mineral regions of the world. The dominance of igneous rocks in the plateau, and the Sierras, as indicated previously, make these the great metal-producing sections. Coal and oil occur in the sedimentary rocks of the slopes and coastal lowlands. The history of the mining of precious metals is indissolubly associated with the post-Columbian history of the country. It was the hope of finding stores of gold and silver that led the Spanish *conquistadores* over mountain, plain, and desert, hundreds of miles from the center of Spanish power. Within 2 or 3 years after the conquest of Mexico, the deposits of Zacatecas and San Luis Potosi were discovered by the Spanish. The silver vein of Guanajuato, one of the most famous silver-mining districts in the world, was discovered about 1525. The first silver mining of importance began about 1548, and for 300 years the mines of Guanajuato furnished one-fifth, and for 100 years about two-fifths, of the silver of the world. Today, even after 400 years of nearly continuous exploitation, the mines, until about 1940 dominated by United States capital that has caused the shafts to be deepened and huge metallurgical works to be erected are still paying dividends. Mexico still accounts for about 40 per cent of the world's output of silver. Up to date, the Guana-

Fig. 278. The donkey continues to be an important beast of burden for many people in Mexico. *Courtesy, H. H. Josselson.*

juato mineral region has produced upward of $1,500,000,000 worth of silver. Many of the great mining centers of today received their charters as cities from the Spanish Crown before the year 1550.

The stores of precious minerals helped to make many men of Spain gentlemen of leisure, adventurers, and cruel governors, disdainful of industry and trade. It is possible that some of these social ideals motivate the Spanish Creoles of Mexico today.

The War of Independence and the numerous revolutions that followed (1810–1821) interfered with the mining industry, for each revolutionary leader sought to control one or more mines as a source of revenue. Many mines were, therefore, abandoned by their owners. Also, the crude machinery used limited the depth to which shafts could be dug. Many mines became flooded because of inefficient pumps, and cave-ins occurred. Only the most productive ores were worked, and there has been much waste through lack of knowledge of scientific metallurgy.

Mining today is carried on in 24 of the 29 territories. Silver is by far the most common mineral mined, but since the 1920's copper has been produced in increasing quantities.

The list of minerals includes nearly all those known to man—mercury, lead, tin, antimony, zinc, graphite, salt, and asphalt, besides gold, silver, copper, and iron ore. Coal, as we have seen, exists in Coahuila and Sonora, and in the early 1920's Mexico was the second great oil-producing country in the world. In July, 1908, one of the greatest gushers known was struck in the Tampico region, producing 60,000–75,000 barrels of oil a day. The oil flowed in such quantities that the operators could not provide steel tanks, and dirt reservoirs were thrown up. In later developments several wells were bored that produced 100,000 barrels a day, and one well alone, up to 1920, produced more than 800,000,000 barrels. From 1921 to 1925 the average annual production was 156,000,000 barrels. But since 1925 there has been a decline. In 1939 only 43,000,000 barrels were pumped, and in 1950, 72,400,000 barrels. Producing wells now number about 800 and are not increasing. Most of the oil is exported in the crude state, but Mexico has two of the largest refineries in the world, and since 1945 a large oil refinery has been operative in the suburbs of Mexico City, turning out gasoline for the increasing home use. Both the production and consumption of petroleum are increasing in Mexico (Fig. 279).

Oil has long been known to exist, but, at first, efforts to secure it were not successful. In 1900 a United States firm, through encouragement from Diaz, purchased land from the Mexican Government and began drilling. Being pioneers, United States concerns were able to secure the larger part of the oil-bearing lands, and at one time, according to some reports, they controlled 80 per cent of the oil fields. The other holdings belonged to British and Mexican firms. Oil was the leading mineral product of the country. After 1921 there was a lull in production because of controversies over titles and export duties. The decision of the Supreme Court of Mexico late in 1927 gave much hope to companies that secured land titles before 1917, the date of the new constitution of Mexico. However, in 1938 the government expropriated the properties of all foreign oil companies and planned a compensation to be paid over a 10 year period. The new government-controlled company, known as Petroleos Mexicanos, or Pemex, has as its object the development of petroleum for the benefit of Mexico. The other oil region of Mexico of some promise is the Tehuantepec-Tabasco section.

Manufacturing. The natural conditions for manufacturing are excellent in many parts of Mexico. The raw materials are abundant and varied, and there is no lack of power resources. In the northern half of the country the low rainfall of the summer results in low water, and there are no lofty snow fields, but on the borders of the Central Plateau, as previously stated, the flow of streams is more constant and the total fall is immense. Most types of industries are represented in Mexico, but few by large-scale modern factories. These industries have grown up under the protection of a high tariff wall and also because of the high freight charges on imported goods. Because of the somewhat unsettled industrial conditions and the changing value of the peso in relation to foreign money, manufacturing did not thrive in the decade following 1930. An expansion began during World War II and has continued since that time. Mexico, D.F., produces more than one-fourth of all the manufactures, which are varied in nature, including clothing manufacture, oil refining, tobacco manufacturing, brewing, and food processing. The textile industry is centered at Puebla and Orizaba; Monterey is the "steel city." Since 1940 United States companies have established numerous

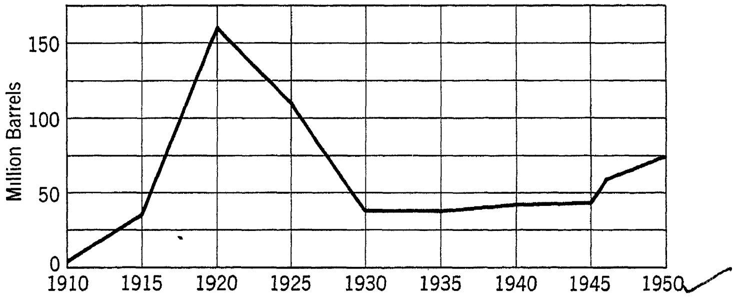

Fig. 279. The rise and decline of petroleum production in Mexico. *World Almanac, 1950.*

branch manufacturing plants in Mexico, turning out machinery, photographic films, cellophane, pharmaceuticals, radios, and chemicals. To be sure, the manufacturing industry is very important to Mexico, but as yet it amounts to a very small figure compared with that of some of the states of the United States.

Manufactured products make up a large part of the imports, and, with the exception of metals, almost no manufactured goods are exported. Practically two-thirds of the export of Mexico is from the mines, and more than three-fourths of all exports go to the United States. Also, the United States supplies more than three-fourths of the imports. Mexico's proximity to the United States, now the greatest creditor nation of the world, with an abundance of capital ready to flow into foreign fields wherever safety is assured, should prove of great value in the development of manufactures in the future.

A Region of Undeveloped Resources. More than a century ago, Humboldt, who was the first to call the attention of the world to the great resources of the country, compared Mexico to "a beggar sitting on a bag of gold." That comparison is not inept today, for, in spite of the great resources of the soil, the forest, the pastures, and the rocks, the country is not prosperous; and, though at times it has risen to a place of promise among the nations of the world, for the larger part of the last century and a half the vast bulk of the people have been hungry and in rags, and the resources undeveloped. The country has long interested and often disappointed the capitalists of North America and Europe, and the civil unrest has created political problems at home, as well as placing a strain on foreign relations. *What are the reasons for this condition? Is there no hope for the future?*

The questions posed are difficult to answer. The greater diversity of lands and resources on the one hand, and the lack of success on the part of the Mexican people to bind themselves together as a firm national unit on the other hand are readily recited as cause and effect. It is undoubtedly true that the cause is closely related to the effect, but there is much more to a solution of the problem than this. The student realizes more than ever before that man himself—his history, traditions, culture, race—may play a great part in explaining human adjustments to the environment. To this end we should consider, in more detail, man in Mexico.

THE PEOPLE OF MEXICO

Mexico resemles most of the other Latin American countries in that it has been difficult for it to produce a firmly unified society. Here the original Spaniards met Indians who were somewhat advanced and already well established on the land, who worked the minerals, and who had a culture and a way of living that had been fixed by centuries. Their numbers, in all that is now Mexico, have been estimated at about 6,000,000, which some authorities believe is much too conservative. The Spaniards who came in the colonial period probably numbered not more than 300,000, but they had superior skills and techniques, and thus were able to make a political and economic conquest of the much larger body of native people.

In the homeland of old Spain there was never a very large population to bring about a pressure for emigration, and the people were solidly Roman Catholic. There were no great numbers to draw upon for colonization, and there was little likelihood that religious groups would arise to seek freedom in the new land; Mexico was far away and there were hardships and dangers there. The result was that many of the Spaniards who came to America did not bring women and children, but took Indian wives in Mexico. The population of the country soon became mixed, so that today Mexico's 25,000,000 people are about 90 per cent Indian and mestizo, 29 per cent being full-blooded Indians. Of unmixed European descent the numbers in the country are less than 9 per cent. The mestizos are gaining in numbers over the pure-blooded groups.

With this mixture of its people Mexico has struggled for more than 4 centuries to bring about a coherent society, and has only made a beginning, as is witnessed by the wide social and economic barriers that still exist between groups. Several millions of pure-blooded Indians live in isolated and mountain sections, having little if any connections with the national capitol, and do not even speak the Spanish language. A large part of the mestizo class has until the land reform of 1933 been landless and poverty-ridden, and a small minority of Spanish and a few mestizos have owned the property, been educated, lived well, and have governed the country.

Students of political history should interpret the lack of unification of the Mexican people with understanding. It does not necessarily follow that the Spaniards have proved themselves poor colonizers and ineffective builders of culture and unity in the people. The problems of establishing order among social groups with such differences have been much greater than was so in Anglo-America.

LAND TENURE AND THE REFORMS

The original Indians in Mexico knew serfdom, for it existed among them before the coming of the Spanish. Some Aztecs were large land holders and powerful leaders, who held many of the lower classes in bondage to do the work on the land. But, as has been stated, the greatest numbers of Indians lived in communities where they grew crops, erected dwellings, and worked the mines; they did not think, however, in terms of private ownership of land. In conquering the country the Spaniards found it convenient to take over communities and force the natives to a life of peonage. Thus was born in Mexico the hacienda, where an individual, usually a Spaniard, received a grant of land from the Spanish Crown for his private ownership. It was mediaeval in nature and was understood to include the right to work the natives who lived on the land. These natives not only grew crops for their own subsistence, but also had to contribute products as a tribute to the lord.

These feudal estates grew in number, and as early as 1825 nearly all good land in the country was in a few private hands. The estates were further extended in the Diaz regime, as has been noted, till by 1910 they included much land that was not very productive. Large areas, heretofore held as public domain—forests, mines and semiarid lands—were shifted to private ownership, and 85 per cent of the heads of all rural families were landless, in a country primarily agricultural. Eleven million people out of a total of 15,000,000 at the time were living in serfdom. No other Latin American country has ever had as great a proportion of oppressed people.

The hacienda system of land tenure, with all the economic and social conditions attending it, continued in Mexico till in the first decade of the twentieth century. The diet of the peon, as it has, no doubt, of Indians in Mexico for centuries, consisted largely of maize and beans. It was not improved upon very much, nor was there an oversupply for the peon. They grew their basic food crops and a little surplus to pay tribute to the lords of the land. There was no incentive for work, and the majority were illiterate; hence there was not progress made in rising from the low social status. Music, social gatherings, as little work as was necessary, cock fights, bull fights, and the hardships and dangers of revolutions were the routines of life (Fig. 280).

The peons took no part in the government of the country, except the revolutions, and had no part in a local governing order, but accepted rule from above. Following the Diaz regime the social gap between the aristocracy and the landless widened further than ever before.

This system of land ownership in Mexico was the source of much trouble throughout the history of the country. Revolts and revolutions were common and generally had their origins in the agrarian unrest. Some land reforms began with Carranza in 1915, became incorporated in the constitution in 1917, and were further revised in 1933, providing for a program of land redistribution. By 1940 much land had been expropriated from large owners and assigned to those who had been landless. The hacienda as a feudal estate has nearly vanished, except perhaps in some of the semiarid cattle lands. There are two forms of land ownership today. The first is the less extensive private ownership, and the second is the "ejido," a form of communal holding.[1] By 1940, 43.2 per cent of the land properties were in private holdings and 56.8 per cent were held by the ejido. Several millions of people are involved in the land reforms, but the complete results of the program are not yet felt, and there remains a minority group which opposes it.

Fig. 280 The arena for bull-fights is found in villages throughout Mexico today.

The accomplishments of the land-reform program are difficult to evaluate. Records show that there has been a decline in production in wheat, beans, and corn, the basic food crops, since the program was put into effect. Production on the ejidos is less efficient than it was on the hacienda, as is shown by the lower yields per acre of maize, cotton, and several other crops. In fact the average worker is not as well off from the standpoint of income as he was before the land reform of the 1930's. The redistribution of lands has resulted in expanding the agricultural areas into semiarid regions and into places with steeper slopes, to take care of the normal increase in population. These formerly landless people do not have experience; they lack knowledge and technical training, so necessary in dealing with water conservation, preservation of soil, and modern cropping practices; yet they are given federal aid and responsibility in developing new areas, and in carrying on in the older areas. It is reported there is a marked increase in gullying, soil erosion, silting of streams, loss of ground water, and other evidences, indicating the evil results of the land reform.

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[1] *Ejido,* a term inherited from Old Spain. It referred there to the communal open space surrounding a village, was neither in crop nor pasture, and literally meant the "way out."

To all who oppose the land reforms it must be pointed out, as shown previously, that Mexico is a country with a large proportion of semi-arid and sloping lands, and the population is increasing. It is altogether possible that the evils attributed to the land reforms, cited above, might have taken place under a continuation of the hacienda system. Therefore, one should avoid attributing the evils to the ejido and private-ownership practices following the land reform. Furthermore, reports show that illiteracy is declining quite rapidly, having dropped from 70 per cent in 1910 to 51.5 per cent in 1940. Retail business has improved since 1940, for the country as a whole, which reflects the wider distribution of incomes. Undoubtedly the greater personal freedom given the people is a gain of great value, and will operate favorably toward bringing about a national unity. Time will be required for such intangible gains to be proved.

SUMMARY

Mexico is a country of great diversity in land and resources, as well as people. Poverty, revolutions, and lack of high national development cannot be attributed to the nature of its lands alone, but to the nature of its people as well. The impact of the Spaniards on Indians, involving great numbers of the Indians, created problems of tremendous proportions in bringing about a coherent society, which is so essential to national development. More than 4 centuries of history in Mexico records this lack of unity. Foreign capital invested in Mexico in mines, oil, railroads, and otherwise has been beneficial in some respects, but the benefits did not affect the masses.

✓ The land reforms, nationalization of railroads, mines, and other resources all show that the nation is attempting to do something in this fundamental strife towards social unification in Mexico, without which there can be no firm national status.

QUESTIONS, EXERCISES, AND PROBLEMS

1. Throughout what physiographic provinces, temperature regions, and rainfall areas would one pass in a journey from Veracruz to Nogales by way of Mexico, D.F.? What type of vegetation and crops would one see?

2. Are there any reasons other than climate for so many people living in Mexico City? How do you account for its having so large a population?

3. To what extent has climate affected the distribution of population in Mexico?

4. Contrast the hacienda and the ejido as forms of land tenure in Mexico.

5. Make a study of the recent development of manufacturing in Mexico. Is there a firm basis in Mexico for increased manufacturing? How would an increase in manufacturing affect the general social order in Mexico?

6. Make a special study of Baja California. What are the prospects of its development?

CHAPTER 27

Middle America

GENERAL PHYSIOGRAPHIC CONSIDERATIONS

North America is joined to South America by a continuous land bridge through Mexico, Central America, and the Isthmus, with the exception of the narrow, man-made cut of the Panama Canal. The mountain belt is continuous from North America through Mexico, but it narrows and ends at the Isthmus of Tehuantepec. Central America is mountainous, but the nature of the mountains and the direction and extent of its ranges and peaks appear to exclude the idea that the Cordillera of North America is directly continuous with the Andes of the southern continent. After careful observation it will be noted that the highlands of Central America, together with the islands of the West Indies, form an orographical system quite distinct from that of North America or South America, the Isthmus of Tehuantepec being the northern boundary and the Atrato River in Colombia the southern. The chain of West Indian Islands extending from Cuba in the northwest to Trinidad in the southeast is really a partially submerged mountain range, also affording a link between the two continents. There is evidence that Central America owes its present form to the union of formerly separate islands which were joined by outpourings of volcanic material. Contrasts between the wild animals of South and North America indicate, likewise, that the continents were separate in early geologic time.

Central America and the West Indies are sufficiently different from the two large American continents, geologically, to warrant the name which we shall apply to them—Middle America. These two divisions of Middle America have many things in common, for, besides being similar in geologic origin and location, the shores of all are washed by the Caribbean Sea; they both lie in the path of the *Northeast Trades*; they have similar temperature conditions, similar indigenous plant life, and similar crops; and a large part of the main line of their histories is similar (Fig. 281).

CENTRAL AMERICA

The Central American Union. In Spanish colonial days the Central American states, exclusive of Panama, formed one province, Guatemala, under a captain-general who had his seat of government at Guatemala City. Even Chiapas, now a state of Mexico, which is topographically, geologically, and climatically a part of Central America, was attached to Guatemala. The feeling of brotherhood that existed among the Latin American nations during and following the Wars of Independence no doubt was the reason for Guatemala's uniting, in 1821, with Mexico, with Iturbide as Emperor. But topographic conditions do not favor large political units anywhere in the highlands of tropical Latin America. To escape the discomforts of the hot, moist climate of the coastal lowlands (Fig. 9), the white rulers in colonial days selected highlands for their homes, where the climate is more like that of Spain. There, centers of population grew up. These centers being separated from each other by scores or hundreds of miles, each became a seat of government. The size of the political unit formed depended for the most part on the distance between the centers. In 1823 Guatemala declared itself separate from Mexico (Chiapas remained), and the next year was reorganized as the Republic of Central America. But the tendency toward separation asserted itself again, one by one the natural political units separated from the Central American nation, and there came to be five small independent countries—Guatemala, Honduras, Salvador, Costa Rica, and Nicaragua.

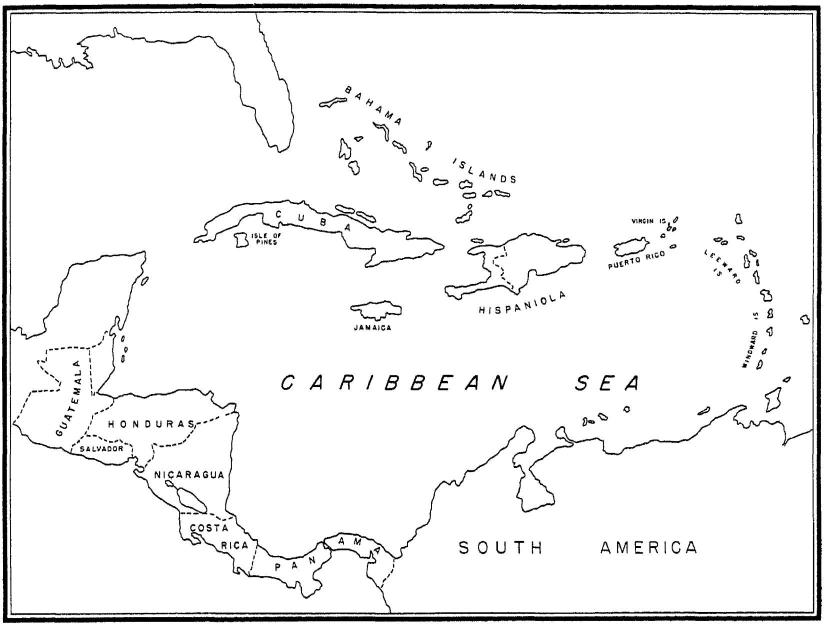

Fig. 281 Outline map of Middle America.

There have been attempts to revive the Union, but until all the population nuclei that have grown up about each capital are closely united by railroads and highways there is little possibility of the formation of a strong federation.

Surface Features and Rocks. The main topographic features of the countries of Central America are similar. There is a mountain and plateau highland extending longitudinally near the center. This highland area lies nearer the Pacific side of the area, and hence the steeper slope is on the west side. The eastern slope forms wide plains in Guatemala, Honduras, and Nicaragua. The larger rivers flow into the Caribbean, a few being navigable for small boats a considerable distance from the sea. Most of the rivers, however, are partially closed at their mouths by sand bars. Lake Nicaragua lies between two mountain ranges, and, although near the Pacific, it drains eastward through the San Juan River into the Caribbean.

Central America has a great variety of geologic formations. There are very ancient rocks like those of the Piedmont Plateau and Old Land of Canada, which contain a great variety of metallic minerals, including gold, silver, copper, lead, and tin. These deposits have been little exploited because of lack of capital and dense vegetation which prevents exploration. There are coal beds in rock of the same age as the coal-bearing rocks of the United States.

Vulcanism has been active in many parts of the highland area; in fact, some of the highest peaks are of volcanic origin, and the plateau to some degree owes its height to lava deposits. The region is young geologically, earthquakes are frequent, and violent volcanic eruptions are common. The rich soil of many parts of the highland is volcanic in origin, derived from volcanic cinders and ash which have buried large areas several feet deep at times. In other sections the high temperature, abundant moisture, and decaying vegetation rapidly disintegrate the rocks and make them into deep, rich soil. Although there is some surface wash from heavy rains and probably rapid leaching, the soil-making processes are rapid, and there is little depleted land.

Climate and Population Distribution. Central America lies within the tropics. The lowlands are, therefore, in the *Tierra Caliente.* In the highland section the temperatures are mild and pleasant, making the plateau a delightful region in which to live, and the *Northeast Trades* bring great quantities of moisture from the Atlantic and the Caribbean Sea. On the eastern lowlands it is jokingly said that it rains 13 months in the year; yet there is here a wet season, the heaviest rain coming in the summer when the equatorial belt of rains shifts northward over all of Central America and much of Mexico. The western slopes and highland have their wet season from May to September. There is an overabundance of rain on the eastern lowlands, whereas on the western slopes there is need of irrigation in some places. At some points on the eastern lowlands the rainfall is 195 inches a year; on much of the highlands it is only 27 inches. The hot, moist climate on the eastern lowlands make that region unsuited to white population.

Most of the people of Central America, nearly all the important cities, and most of the railroads, roads, and cultivated lands are on the highlands. In some of the countries, 75 per cent or more of the people are on the plateau.

Climate and Plants. It is not difficult to find a correlation between vegetation density and amount of rainfall. The vegetation is more luxuriand and varied on the lowlands, but still it is abundant in the higher and drier portions. There is a wide range of natural plant life and of cultivated crops.

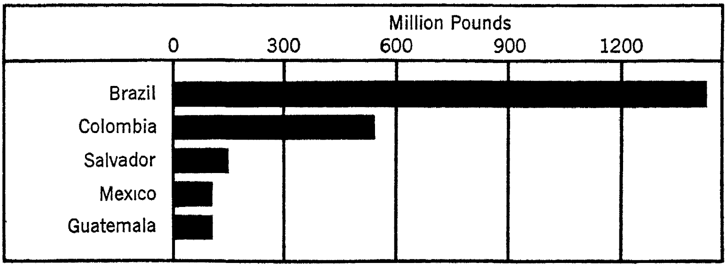

Fig. 282. Coffee imported into the United States by country of origin in 1951.

On the eastern lowlands the forests contain mahogany, ebony, rosewood, and cedar, which are cut and shipped to the United States. In some sections a "chocolate" tree grows wild. There are also medicinal plants furnishing vegetable oils, and also rubber-producing trees. More than half a hundred varieties of banana trees are indigenous to the region. The drier parts of Central America are covered with savannas (tropical grasslands with scattered trees), excellent regions for the grazing of cattle and horses, and lands suitable for the cultivation of some crops. Some parts of Guatemala are too dry for cultivation except through irrigation. Pines and oaks are found in the higher parts of the uplands.

Temperature is a factor in the vertical distribution of economic plants in Central America. Up to 1500 feet the products are chiefly tropical. At a few places on the lowlands the forests have been removed, and great banana, rubber, cacao, and sugar plantations have been made, where native Indians and West Indian natives work under the supervision of white men from the Unted States or from the highlands of Central

America. For the most part, the chief occupation of the people on the lowlands, other than the work on the plantations, is timber cutting and the collecting of wild forest products that have commercial value. This region is producing only a small part of what it is capable of, because so few people live here. Coffee plantations are common in most of the republics between 2000 and 4500 feet above the sea (Fig. 282). Here, also, may be grown sugar cane and cotton. Some of these countries, particularly Costa Rica, produce a very excellent coffee which for a long time was sent mostly to European markets, but now the United States takes more than three-fourths of the export. In Guatemala, coffee plantations were chiefly in the hands of German settlers, till World War II, when the government confiscated much of the property and went into the plantation business for itself. Crops like those of central United States are grown on the highlands above 5000 feet—wheat, corn, beans, potatoes, and other vegetables. Corn and beans have a wide range of distribution.

Economic Opportunities. Many travelers have spoken in high terms of the great opportunities offered in Central America for man to make a living and prosper. The climate and soil offer optimum conditions for plant growth. Bennett reports, "There is little soil erosion even on slopes that would be hopeless in our latitude." As many as 4 crops a year may be grown. The wide variety of mineral deposits has been commented on. The admirable position of the whole region, between the Atlantic and the Pacific, with good harbors and long coast lines, should give it abundant opportunities to get products to the markets of the world. The people in some of the countries have lived up to the opportunities nature offers and have made much progress.

Progress and Anarchy in Central American Countries. Costa Rica and Salvador have made much advance in transportation, commerce, agriculture and education. Costa Rica is undoubtedly the most prosperous of the Central American republics. For the past century it has not had civil strife and revolutions to the extent found in other Central American republics. The Costa Ricans dislike wasting their resources in wars or on war material, preferring the arts of peace, and they welcome those bringing wealth from other countries. Foreign capital has been invested to help develop the resources. On the eastern coast, the United Fruit Company has large holdings of land. The forests have been removed from large areas, swamps drained, railroads built, and the land planted with banana trees. Limon is the chief port, and from this center 5,000,000 to 8,000,000 bunches (300 to 400 shiploads) of bananas are exported each year (Figs. 283 and 284).

In January, 1932, the independent banana growers of Costa Rica were informed that contracts with planters of old plantings would not be re-

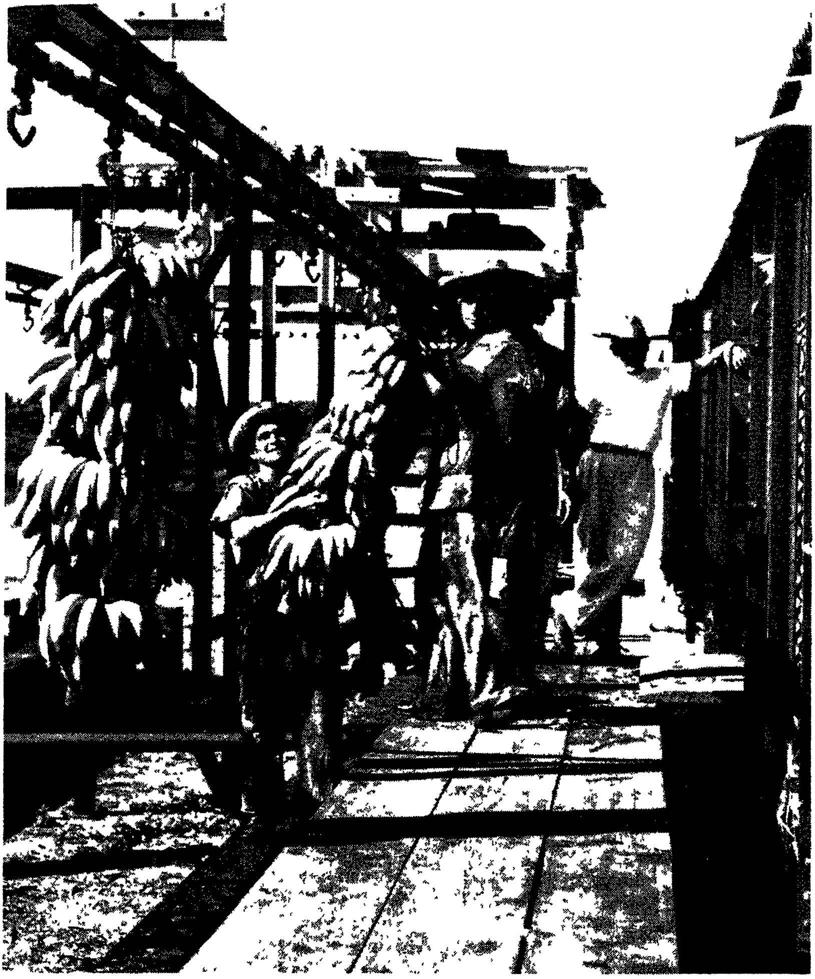

Fig. 283. Workers transfer banana stems from the mechanical fruit washer to railroad cars for the trip to a Puerto Rican port, from where a United Fruit Company ship will carry them north. Bananas are cut when green, for, if they are allowed to ripen on the tree, they are injured in handling and become infested with insects. Mechanical equipment takes the place of much of the hand labor that was formerly employed in processing and shipping of bananas. *Courtesy, United Fruit Co.*

newed, the reason given being that the old, worn-out lands would not grow first-class fruit. The United Fruit Company has since brought prosperity to this hitherto undeveloped section. In 1948 Costa Rica had 38,500 acres devoted to banana plantations, ranking second only to Honduras among all Central American republics, which had 44,500 acres. A railway from Limon to San José gives a large area of productive land an outlet to United States and European markets. The company maintains a large fleet of fruit, freight, and passenger ships from Limon to United States ports. Much of the economic life of the plateau is based on coffee culture for export, and coffee growing has tended to keep the country free from revolutions. The planters early found that their orchards on which their prosperity depended and which required years to develop, could be destroyed within a few hours during a revolution. A start on production of rubber was begun in 1939 when more than 1000 acres were planted in the lowlands along the Caribbean littoral.

Costa Rica is a real democracy. There is freedom of the press and religion. The land for the most part is in small plots which, in general, are worked by the owners. There is no tax on land, a condition that encourages land ownership. The country has an excellent educational system with compulsory education, schools, and good teachers. The mineral deposits are being worked actively, and the exports amount to about four times those of any other Central American country.

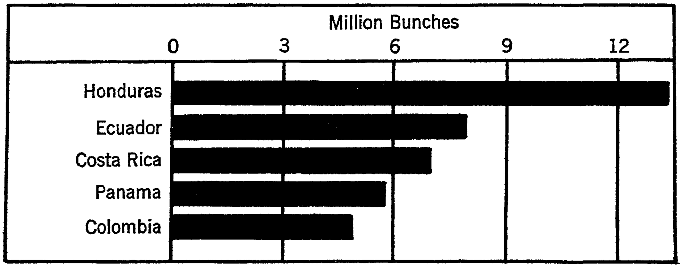

Fig. 284. Bananas imported into the United States, by country of origin in 1951.

The character of the people is the chief reason for the fine progress that Costa Rica has made. Fully 60 per cent of the total population is white, and 80 per cent of the people of the *meseta* or central plateau are white. This part of Central America was settled by poor Spanish families, and, since the Indian population was small, slave labor or peonage has never been a factor in the economic life of the country. There are only 3500 pure-blooded aborigines in the country at present. The people, from the first, acquired habits of industry which today find their reward in the advancement the country has made. The name Costa Rica, it is said, was a joke in colonial days because the country was held by poor Spaniards who were forced to work for a living.

At the other extreme of economic and political development stands Honduras, with a public debt in 1909 of much over $135,000,000, most of which was interest which had not been paid since 1872. A part of this debt was contracted to construct railroads, most of which were never built, the funds being squandered by public officials. However, much progress has been made since, and by 1940 the country was operating on a balanced budget. There has been little development in the country except along the coast where foreign companies have banana and sugar plantations. However, the banana plantations on the Nicaraguan east coast were mostly destroyed by disease in 1940 and have not risen to great importance since. The laborers on these coast lands are mostly West Indian Negroes. Concessions have been granted for the exploitation of the forest and mineral resources, but little work has been done because of constant political disturbances. There are but few schools outside the towns. Roads are few, and all the half dozen short railroads are on the coastal lowlands and do not reach the section where most of the people are. The population density is about 12.5 to the square mile, and the population is largely made up of aboriginal Indians. About 20 per cent of the Indians are uncivilized. Similar in political and economic conditions to Honduras are Guatemala and Nicaragua.

Railroads and Ports. Transportation facilities, essential adjuncts to all economic development, are greatly lacking. Railroads are very few, and the lines are short. Railroad building is difficult because of the rough topography and the heavy forests in the tropical portions; and when once built, the railroads are subject to frequent and disastrous washouts from the heavy tropical rains. Some single rains cause more than a million dollars' damage on a single line and incapacitate the road for several months. The railroads in most cases are not paying ventures, because the population density is low, the flow of commerce is light, and there is no great system of routes that tends to bring about an exchange of commodities over a large area. Railroad building has been generally neglected in Central America, chiefly from lack of capital and the prevalence of graft, but also because the dictators have opposed it. "The dictator has seen in steel rails a drawbridge over the moat into his baronial castle." The area is really too small to develop any extensive system. Most of the roads in each country center at the capitals and extend to one of the important seaports. In Guatemala, Costa Rica, and Panama there are railroad connections between the east and west coasts. Port facilities are surprisingly good on the east coast. There are five natural harbors: Puerto Barrios in Guatemala; Trujillo and Puerto Cortez in Honduras; Limon in Costa Rica; and Bocas del Toro in Panama. These have been improved, but mostly by foreign companies. The handling of cargoes on the west coast is done with few exceptions by lighters. At some points the water is so shallow that even the lighters do not touch the shores, the longshoremen being obliged to wade to and from the lighter.

Before 1920, the most highly developed part of Central America was shut off from any contact with Europe and the United States by being located on the Pacific Slope, which necessitated a long land haul to get to the coast of the Caribbean or a long sea voyage around the Horn. The Panama Canal, however, has put the densely settled sections in easy contact with the Atlantic traffic lines and will aid greatly in their future growth and development. Unfortunately, the portions of these countries that produce the agricultural and forest products that Temperate Zone people are calling for, such as sugar, rubber, and bananas, have been shunned by the white man in the past and have been little developed. The highlands produce commodities that are comparable in many respects to those of temperate lands, and for which there is no great call in the markets of Europe and America. However, improved sanitation has reduced many of the "horrors" of the moist tropics, and the white man sees in these lands great possibilities. Some of the most prosperous and most peaceful sections of these countries today are on the east coast, where the great development companies have cleared off the forests, drained the land, built towns, wharves, railroads, hospitals, churches, and schools, given work to thousands, and maintained peace. The regeneration of these countries may yet come from the hitherto neglected wet tropical coast lands.

British Honduras is the only remaining colonial possession in Central America. It was acquired from Spain by the British in 1670. It is a tropical, rainy land poorly suited for permanent settlement except on the islands along the coast. The industries are extractive in nature and consist of the gathering of chicle and logs for lumber. The total population in 1950 was only 70,000, of which nearly 50 per cent were Negro and mulatto. About 25 per cent are Maya Indians, and only 4 per cent are white.

WEST INDIES

To the east of Central America and Yucatan and between North and South America is a great watery expanse, 1600 miles east and west, and 1200 miles north and south, strewn with islands varying in size from the area of a village lot to that of the average United States state. These islands number in the thousands; some are barren; some are in their native condition, covered with forests; some are unsettled; some have well tilled farms; plantations, and cities. Cuba, the largest of the West Indian islands, and one of the Greater Antilles, has an area of 44,000 square miles—about that of Tennessee. The second in area is the island of Hispaniola (Haiti), which has 30,000 square miles—nearly the size of South Carolina.

The Islands Classified as to Origin. The West Indian islands are commonly divided into the Greater and the Lesser Antilles, the Anegada Passage to the east of the Virgin Islands forming the dividing line. The Bahama Islands, though somewhat isolated from the West Indies and forming a large group of some 700 islands and islets and more than 2000 rocks, may well be classed with that island world.

The physical features and bedrock vary greatly in the different islands of the West Indies. The Greater Antilles are continental in structure, character of rocks, and surface features. The Lesser Antilles are typical oceanic islands. The Bahamas are mostly low islands of calcareous materials.

Many of the islands of the Lesser Antilles are simply the tops of great mountain masses whose bases rest on the sea bottom several thousand feet below the surface of the ocean. One writer expresses this tersely by saying that in the Lesser Antilles one goes to the top of the mountain in a boat. In most of the islands, however, the mountain peaks stand far above the sea level.

In the West Indian section great earth movements have occurred in recent geologic periods. The whole of the region has been depressed, some portions more than others, those deeply depressed forming basins. Just to the north of Puerto Rico is a depressed ocean basin about 25,000 feet deep. The Bahamas are low hillocks on a broad submarine plain, similar in surface features to Florida, and might well be considered as an extension of the Florida peninsula.

The islands of the inner row of the Lesser Antilles are largely of volcanic material, or are remnants of huge heaps of old volcanic material carved by running water and waves. The outer row of the Lesser Antilles is truly coraline, coral forming massive layers of limestone that mantle the surface and form a fringe about the coast. It is possible that the core of many of these coraline islands is of igneous rock. Barbados has sandstone and sandy shale as its basal rock, much of which is impregnated with petroleum. Resting on this is deep-sea limestone and siliceous clay. Coral forming is active at present about the shores of most of the islands of the West Indies.

Climatic Conditions and Effects. The climate is similar in all the islands of the West Indian region. The lowlands are in the *always hot* temperature region; the mountains are much cooler. In the highlands of the interior of Cuba the thermometer occasionally falls to freezing point, and thin ice will form in December and January when the winds are in the north. The whole region lies in the *Trades*, with steady winds from the northeast in the Greater Antilles, and from the east and southeast in the Lesser Antilles. Because there is so much water and so little land, the climate is oceanic in every respect. The range of temperature is slight, and the air has a high relative humidity. In the larger islands rain is heavy on the windward side of the mountain slopes. The outer parts of the lowlands and the offshore islands on the windward side of the larger islands have little rain.

On the leeward side there is also little rain, and irrigation is necessary for profitable agriculture on most of the islands. In Jamaica the annual rainfall in different sections varies from about 25 inches to nearly 200, and in Puerto Rico from 20 to 100 inches. Salt is made from sea water along the lagoons by natural evaporation, on the north shore of Cuba, because here the rain is slight and the *Trades* are drying winds. On the south slope of Cuba, the slight rainfall permits only a thin growth of trees. Here the Spaniards early settled to work the placer deposits of gold and silver. The distribution of crops is adjusted to these different amounts of rainfall. Sugar and bananas are the most important of the products raised on the hot, moist portions of the lowlands. In some islands, rubber, cacao, and rice are produced. Coffee is confined to well-drained hill and mountain slopes in the less humid sections, and some of the finest tobacco in the world comes from the southward-facing valleys of western Cuba where the rainfall is much less than on the northern slope. Cattle are raised in some of the isolated sections of the Greater Antilles, where the forests have been removed or where savannas are the natural vegetation. The Lesser Antilles in general have plenty of rainfall, heavy rains falling almost every day in summer. Occasionally there are cloudbursts that cause considerable damage. The most unfavorable features of the climate are the hurricanes, or tropical cyclones, which are common and very destructive.

The climate of the West Indies is remarkably healthful in spite of the fact that it is tropical. The *Trades* are the saving feature. On some of the islands, English and French people have lived for generations with little or no apparent ill effects. Alexander Hamilton, the father of Dumas *pére,* and the Empress Josephine were all born in the West Indies on colonial plantations. Some English family names have figured in the history of the West Indies for centuries. Sufficient time has not yet elapsed, however, to determine the fitness or unfitness of the islands for the white race. It is true that the Negro has multiplied with the luxuriance of tropical vegetation, and now far outnumbers the white on many of the islands, and has entirely displaced them on others; but the relative decrease in the number of whites is undoubtedly due, in some degree, to economic factors. The decline of the sugar industry has resulted in the emigration of many whites.

The Mingling of Races and Nations. Probably in no other region of similar area on the earth would one find such a variety of history as in the West Indies. Some tiny islands have histories more voluminous than many an American commonwealth. Because of their position in the *Trade-Wind* belt, nearly opposite the Canary Islands, the point from which many of the early explorers departed, the West Indian islands were the first to be visited by Columbus. By 1514 the Spaniards had visited and taken possession of most of the West Indian islands. Other explorers from Europe came—Dutch, French, and English—and preyed on the Spanish settlements and on the commerce between Spain and the West Indies (a term which for a time included all the Spanish possessions in America). All the nations laid claim to lands in the great island world, sent colonists, and began to exploit the agricultural resources. As the climate was not found favorable for work for the white man, the Indians were enslaved and nearly exterminated by the Spaniards before the coming of other Europeans. Negroes from tropical Africa were imported. The first were brought by the Spaniards in 1502, and in the early part of the nineteenth century the British colonists alone imported 2000 slaves annually. The islands of the West Indies soon became the most valued possessions of the European nations. They were easily reached by sailing vessels following routes set by the North Atlantic winds and ocean currents. Their climate is salubrious, and their natural beauty makes them veritable fairylands. They became the chief source of the world's sugar supply. England, for a hundred years before beet sugar was developed in Europe, fought the Netherlands, Spain, and France for the West Indian sugar lands. In the sixteenth, seventeenth, and eighteenth centuries, the financial prosperity of western Europe was greatly increased by commerce with the West Indies, and the products of these islands were worth more "than all the gold and silver of the American continent." Muscovado,[1] which cost $100 a ton to produce with slave labor, sold for $300 a ton, and many a small West Indian plantation produced for its owner each year in sugar alone 50,000 to $100,000.

The West Indies, being such valuable possessions, naturally became pawns in the great game of empire building. Individual islands, being small and at the same time possessing value both because of their productivity and strategic position, repeatedly changed their political affiliations. In any of the many European wars, a victory for England meant that many of the more important islands became British; and, England being dominant on the sea, the choicest islands, particularly the more strategic, fell to its lot. Some of the less important islands have been in the hands of one nation for centuries; others have frequently changed their flag. One finds French-speaking populations on the islands now owned by Britain, and Spanish-speaking populations on islands under United States control or protection. In Hispaniola the people in the western part speak French, and those in the eastern part, Spanish.

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[1] *Muscovado*—unrefined sugar.

Location, and the various economic opportunities offered, have made the West Indies a region where races have comingled throughout all historic times. As these islands form a chain from the coast of South America to the tip of Florida and almost to Yucatan, it was easy for even primitive men, Caribs and Arawaks, to make a thousand-mile journey by sea in frail canoes on trips of conquest or commerce. The Caribs were canoe people. Columbus wrote of them that "they run through all the islands of India and plunder and take as much as they can." Civilized man in more seaworthy carrying agents has come from much longer distances. The Indian was supplanted by people from Europe and Africa, North America, and South America. Since 1900 thousands of Asiatic coolies have been brought to some of the islands to labor on the plantations, so that in these islands one finds representatives of five of the continents.

To add to the complexity of ethnic relations, there has been much intermarriage of races. Negroes have mixed with Indians, whites with Negroes and Indians, and Asiatics with Negroes and Indians. The pure whites of one nationality have mixed with those of another. The frequent raids of pirates and buccaneers in the early colonial periods added much to the complexity of the language, races, and moral standards. In the Lesser Antilles the Negro element dominates.

Isolation of Islands and Parts of Islands. Seemingly at variance with the evidence of ethnic mixing is the fact that there is a general lack of intercommunication in the West Indies, a condition hardly to be expected when one considers the short sea distance that separates them. This condition is as true between the various parts of the larger islands as between the various islands. The lack of communication is probably the result of the hilly or mountainous topography of the interior of the islands, the primitive condition of many of the people, the general lack of ambition, the poorness of the roads, the density of the forests, the differences in speech, customs, and ideals, and the lack of development of maritime interests by the islanders themselves. As for maritime activity in colonial days, the whites were too busy with the affairs of their plantations to go to sea; there was no large middle class of whites dispossessed of lands; and the lower classes were held in bondage. Most of the carrying trade in colonial days was in the hands of seamen from New England and European countries. Most of the European colonizing nations had navigation laws prohibiting commerce between their colonies and the people of another nation. This checked intercolonial trade. The vessels in colonial days were so small that rarely was it necessary to visit several islands to discharge a cargo lot or secure a shipload. Similarity in products in the islands did not, and does not now, call for intertrade. Now, however, steamer lines make the circuit of many ports, and the water passages are used by many steamers.

The result of this lack of communication has been the development of distinct types of civilization, each of which "assumes the individuality and political importance of an independent empire." Nearby islands present great contrasts in customs, speech, institutions, and opportunities. Herne noted the lack of unity even between parts of the same island. He says, regarding Martinique, "People are born and buried in the same valley without ever having seen towns a few hours' journey beyond their native hills, and distinct racial types are formed within three leagues of each other."

Population Density. Still another characteristic of the islands is the relatively high density of population. Cuba and Hispaniola are comparatively thinly populated, but most of the other islands are more densely peopled than the mainland of the Americas. The average density of the mulatto republic of Santo Domingo (the Dominican Republic) is about 70 (estimated), and for Cuba about 78.5, both of which are comparable to the average of the Southern States of the United States and much above those of the Central American republics. Jamaica has an average of about 211; Puerto Rico, 378; and Barbados, about 1020. The average for the Virgin Islands, a possession of the United States, is about 200. In Barbados the population density has about reached its saturation point, but in most of the other islands there is still much room for growth. So easy is life, so few are the demands nature makes on man, so abundantly does nature supply materials to meet these demands, and so low are the standards of living of the vast majority of the people, that the islands are capable of supporting a population many times as dense as the rural parts of the United States.

THE UNITED STATES SPHERE OF INFLUENCE

Cuba

United States Interests in Cuba. The proximity of Cuba to the United States, 100 miles or so from the tip of Florida, and its strategic position at the Atlantic outlet of the Gulf of Mexico largely explain the interest the people of the United States have long had in that island.

During the nineteenth century it was much coveted by various elements in the United States, first by the leaders in the slave states to prevent the Latin American republics from making it a free territory, and later as a region for the extension of slave territory. From 1848 to 1861 there were repeated attempts to purchase it of Spain. John Quincy Adams, in the early part of the century, when it seemed as though Spain would be forced to relinquish its hold at the bidding of Britain, strongly urged the United States to take steps to acquire possession of the island because of its strategic position. The position of Cuba makes it imperative that its control should never go to a nation that could use it as a base of operations against the United States; and this might have happened as long as the island remained in the hands of a weak power like Spain. The widespread sympathy felt in the United States for the Cubans in their attempts to free themselves of Spanish misrule, and the fact that people of the United States had much capital invested in sugar lands, whose earning power was greatly reduced because of the unsettled conditions, were the chief causes that led the United States to make war against Spain in 1898. At the close of the war the United States assumed the role of protector and adviser of the Cubans whenever it was evident that peace was endangered. For a time the United States army held control in Cuba, but turned over the rule to the Cubans upon the establishment of a responsible government of their own. They seem to have demonstrated their ability for self-government, for in 1936 a treaty was signed with the United States abandoning the right which the United States formerly held of intervening in internal affairs.

United States capital has since the Spanish American war been going into Cuba in increasing amounts. Much of it is in sugar lands, centrals, and railroads and harbor works for the handling of sugar. About 60 per cent of the foreign investments of a billion dollars in sugar in the island is from the United States. Besides investments in the sugar industry, much United States money has gone into railroads, highways, public utilities, industries, mines, and banks.

The United States took about 75 per cent of the exports of Cuba and sold to Cuba over 80 per cent of its imports in 1950. The United States places a limit on importation of Cuban sugar as a protection for its sugar production at home. Nearness to the United States and the reciprocal trade agreements in effect account for the large percentages. United States physicians and sanitary experts in the past have performed inestimable services in Cuba in stamping out yellow fever and other tropical diseases. The 200,000 tourists that visit Cuba each year (in normal times) are largely from the United States, and their expenditures contribute much to the income of many Cubans. Another link that binds

Cuba and the United States is the leasing of Guantanamo Bay for a naval and coaling station, for which an annual rental is paid.

The Quality of the People. The prosperity of the islands (in normal times) and the high regard the great powers have for Cuba are due largely to the abundant resources of the island, the fine character of the Cubans in general, about 70 per cent of whom are white, and the fact that, up to 1936, peace and order were guaranteed, under the Platt Amendment, by the United States. Educational conditions are far superior to those in other American mediterranean countries. About 80 per cent of the people 10 years of age and over can read and write. In 1900 about 45 per cent of the population was illiterate. This change is indicative of the vigor with which the problem of raising the educational standards have been attacked. Free schools are now provided for all children, and attendance is compulsory between the ages of 7 and 14 years. High schools are to be found in most cities, and the University of Habana is one of the most efficient in Latin America.

Like most other Latins, the Cubans take politics seriously. Their temperament is political, and their history is one in which political misgovernment and misrule have played prominent roles. Election riots are common, but serious ones come infrequently.

Agriculture, the Basal Activity. Agriculture is the basal industry of the island, the surface features, soil, and climate being about as favorable as in any section of the world. The land is largely a rolling plain, except for the prominent Sierra Maestra Range (some peaks of which reach 3000–4000 feet and one about 8000) in the far eastern end of the island, the Organ Mountains in Pinar del Rio provinces in the west, and a few low groups of hills here and there in the intervening area. Even in the hills and mountains there are many fertile valleys.

The basal rock of the island is old crystalline, metamorphic, and igneous rock, which outcrops over a large area in the Sierra Maestra Range and here and there in other parts of the island where erosion has removed the sedimentary rock which apparently once covered most of the island. The dominant rock, however, is limestone, and it is from the limestone that most of the soils are derived, both the residual and the alluvial.

Lying on the equatorward side of the 68° isotherm for the coldest month, Cuba has a tropical climate (Fig. 9). Frosts are unknown except on the uplands. The monthly averages for Cienfuegos, which is fairly central and on the south shore, range between 76° for February, the coldest month, and 88° for September, the warmest. Temperatures below 50° and above 90° are rare. On the north coast the effect of a high summer sun is mitigated by the cool winds from the northeast. The rainfall is plentiful. The wet season, during which about two-thirds of the rainfall occurs, is from April to November. The northern slopes of the island receive more rainfall than the southern, but the offshore islands on the north coast are semiarid. Hurricanes, which visit the island once or twice a decade, and severe droughts, which are not uncommon, are the discouraging features in agriculture.

Sugar. Sugar, since even before 1800, has been the dominant export crop of Cuba. Upon sugar, therefore, its price and production, depends largely the degree of prosperity of the island. The value of Cuban foreign commerce rises and falls with the changing price of sugar. There is always grave danger in so limited an economic base, and the history of Cuba well bears this out. Improvements in ocean transportation, changing methods of production, invention of new machinery, new sources of sugar, tariffs, subsidies, and rebates, not to speak of tropical hurricanes and local rebellions, have worried Cuban sugar growers. Competition with European beet sugar and Indian and Java cane has forced the island's industry to adopt modern, large-scale production. This gave an opportunity for United States capital to enter. Large estates have been created, large modern mills with bagasse furnaces, double-grinding and powerful pressing machinery, and vacuum evaporators have been built. Miles of temporary railways now connect each central with the cane fields and larger railways, and give the centrals contact with the shipping ports. The extensive type of cultivation still prevails, however. Migratory cropping dominates on the larger estates, and from 3 to 6 cuttings are taken from a single planting. The United States takes about 90 per cent of the crop in normal times. Molasses, a by-product of sugar, also finds a large market in the United States (Figs. 285, 286, and 287).

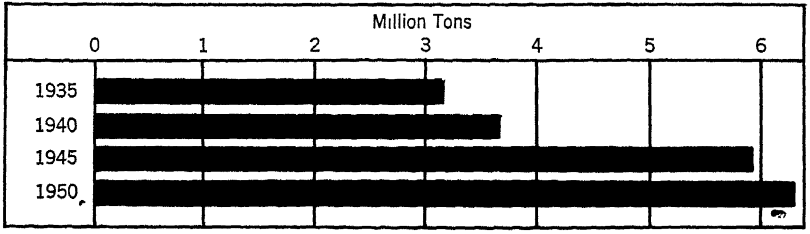

Fig. 285. Sugar production in Cuba, 1935 to 1950 inclusive.

For many years Cuba, India, and Java have been the leading sugar-producing regions of the world. Some years Cuba has been in the lead, only to be surpassed in other years by Java or India. Since 1900 Germany, the United States, and France have increased their sugar production, this being largely from the sugar beet. These heavy producers, along with the Hawaiian Islands, the Philippines, and several European countries, can supply far more sugar than the world can consume. A reduction in the world's consumption leaves large stocks in the hands of the producers. Such has been the situation for many years since World War I. Conditions in the sugar regions of the world were desperate about 1925 and in following years.

Conferences of the world's sugar interests have worked out allotment plans. Under the Chadbourne Plan, the Sugar Stabilization Law, and other agreements and decrees, Cuba's normal crop of nearly 5,000,000 tons (1922–1926 average) had to be cut to but a little more than 3,000,000 for 1931. There was left over from previous years nearly 7,000,000 tons to be "segregated" and disposed of gradually.

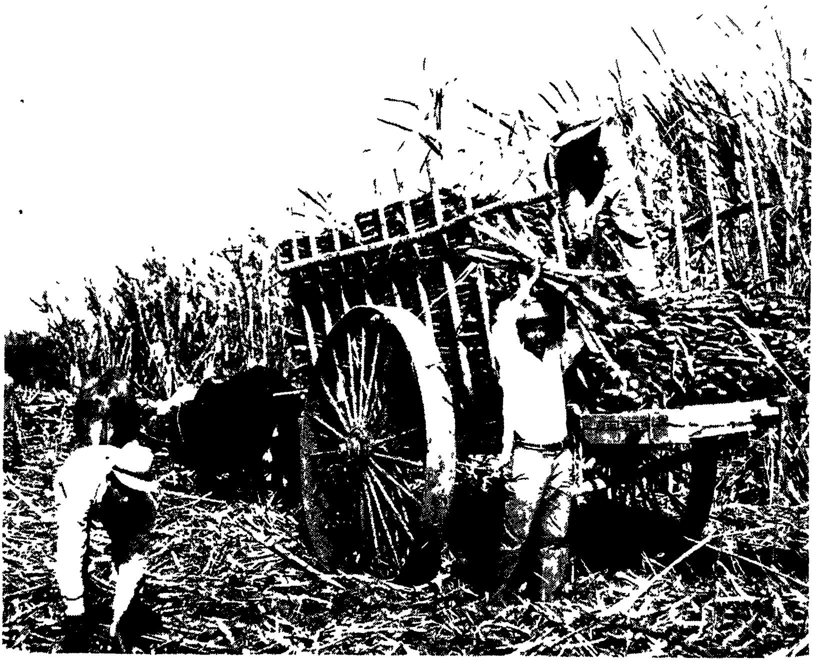

Fig. 286. A typical ox-cart for hauling sugar cane from the plantation to the mill. *Courtesy, Cuban Tourist Commission.* Modern power-driven machinery is fast replacing the oxen and much of the hand labor in the cane fields.

The lower total production and the lower prices have brought great financial distress and much bitter feeling toward the United States sugar "barons." However, with the passing of time, adjustments have been made. In 1951 Cuba produced 6,800,000 tons (Fig. 288).

Tobacco. Cuban tobacco, and particularly Habana cigars and cigarettes, hold a high rank in the world's tobacco markets. The most famous tobacco district is on the southeastern slopes of the Organ Mountains in Pinar del Rio province. From here comes about three-fourths of the island's crop. Cuban soil and climate produce a tobacco distinct from all others in aroma. Mexican and United States tobacco, introduced after destructive wars had about destroyed the native variety, has been found, after being domesticated in Cuba for a few years, to take on many of the characteristics of the old Cuban variety. Santa Clara and Habana province are also heavy producers (Fig. 289).

The high quality demanded calls for intelligent, careful, white labor. Much tobacco is grown under cloth. Plants so grown produce high-grade wrapper leaves, uniform in quality, low in gums and resins, and light in color and weight.

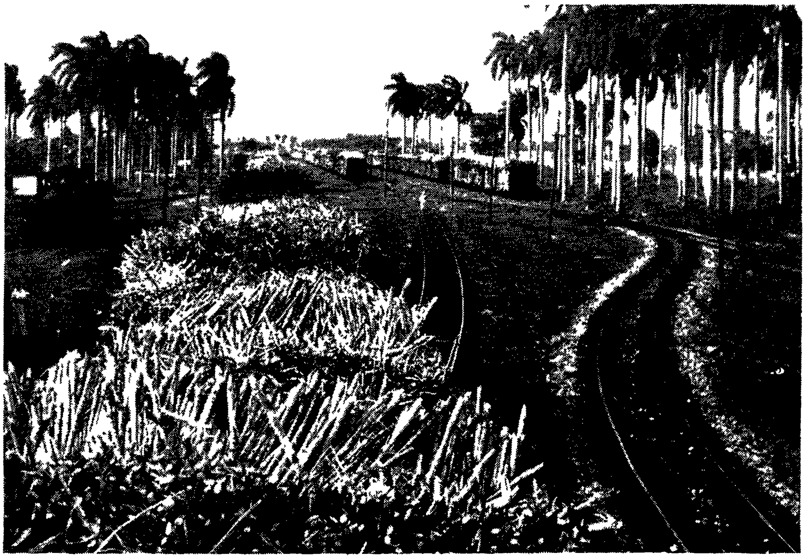

Fig 287. Harvested sugar cane arrives at the mill of the American Sugar Refining Company's Central, Jaronu, Cuba. *Courtesy, United States Cuban Sugar Council.*

The United States is Cuba's best customer. Since Cuban tobacco has few rivals and is in the luxury class because of its high value, the industry suffers much less fluctuation in price and production than sugar.

Minor Products. Fruits, nuts, and vegetables in great variety and quantity are produced, though the methods of cultivation are very primitive. Corn, oil seeds, sisal, honey, coffee, cacao, and yucca are other products. Rice finds Cuba a suitable habitat. The absence of an off season in plant growth enables Cuban farmers to produce grapefruit, pineapples, and garden truck for the winter markets of the United States.

Cuba also produces bananas for export and home consumption. The imports of corn, butter, eggs, vegetables, oils and lard, and canned milk are declining rapidly, and Cuba may soon be self-sufficing in these and other staples. The livestock industry is only in its beginning.

Transportation Facilities. Transportation facilities, both within the island and on the seas, are fairly adequate. There are more than 3000 miles of railroad, not including the 2800 miles of private lines on the 200 large sugar estates. The island has a large number of very excellent harbors. Most are pouch-shaped with narrow entrances, thus offering large areas of well-protected waters for anchorage.

It is reported that automobilists have 1800 miles of good roads. A great Central Highway, 705 miles long, was formally opened in 1931 (Fig. 290). The long coast line and excellent harbors give abundant overseas contact.

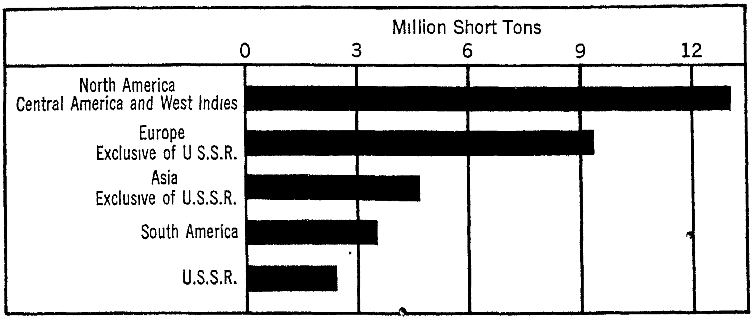

Fig. 288. The sugar crop of the world in 1950.

The Forests. Large areas of Cuba are still in forest (some 8,600,000 acres) containing cabinet and dyewoods. Some of these forests are state owned, but many sugar companies have large areas on their estates, portions of which are cleared from time to time to supply virgin lands.

Manufactures. Manufacturing is mainly the preparation of agricultural products for foreign markets. Raw sugar, cigars, and cigarettes are the most important products manufactured. Among the lesser manufactures are those producing leather, hats, clothing, alcoholic drinks, vegetable oils, furniture, textiles, paints, paper, glass, and cement. These have grown up under the protection of high tariffs to build up Cuban industries. Cuba is making steady progress toward self-sufficiency.

So far little has been done with the island's rich mineral resources. The Oriente province, where the old crystallines outcrop, is the great mineral region. Excellent Bessemer ore (60 per cent iron) is shipped, largely to the United States. High-grade manganese and copper are also mined. Iron ore and copper outcrop in various other sections of the island, wherever the old rocks are exposed. There are in several sections deposits of bitumens, varying from oils to asphalts and lignites. Coal of a high grade is lacking, a factor that serves to deter manufacturing. The building stone most used is limestone, soft when taken from the quarry; it may be shaped with an axe or sawed—it soon hardens when exposed to sun and wind. Some salt is produced.

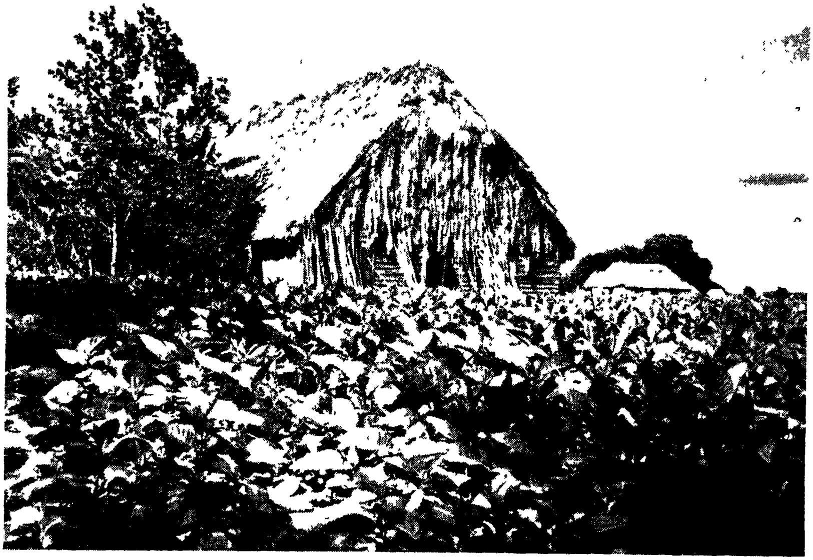

Fig. 289. A tobacco plantation in the world-famous region of Vuelta Abajo, Pinar del Rio, Cuba. Here the soil is sandy and poor, but by the use of fertilizer some of the world's finest tobacco is grown. This tobacco seems to have a quality not obtained elsewhere.

Hispaniola

Hispaniola (Haiti), the second largest of the West Indian islands, lies approximately at latitude 18° north, between Cuba on the west and Puerto Rico on the east. Its area is 30,000 square miles, and it has a population of 5,714,000. Although its size is but one-third that of Cuba, the population is greater. (Cuba, 5,130,000). In a number of respects this island is remarkable. It was discovered and named by Columbus in 1492; gold, that great attraction for the Spanish in the New World, was first discovered here; it was made the center from which the Spanish operated in the Americas; and it was to this island that African slaves in great numbers were introduced to the New World. Yet, Hispaniola is less changed today by man than any of the West Indies.

Like Puerto Rico, it is a wet, tropical land especially on the *Trade-Wind* slopes on the north and east, but in the southwest and in the rainshadow of its mountains it is so arid that in places irrigation has been hampered by salinity of the soil. Lake Enriquillo in the southern part is so dried up that its surface is 100 feet below sea level. Though irregular in shape, Hispaniola is long in east-west direction, and its surface is mountainous. At least three distinct volcanic mountain ridges, 2000–10,000 feet, extend east-west across the island with valleys between, thus lying at right angles to the path of the *Northeast Trades,* and providing great variety for the physical landscape. In places one may travel but 20 or 30 miles and pass from wet, tropical banana land to thorn forest, or upslope to temperate-land crops and pine forests.

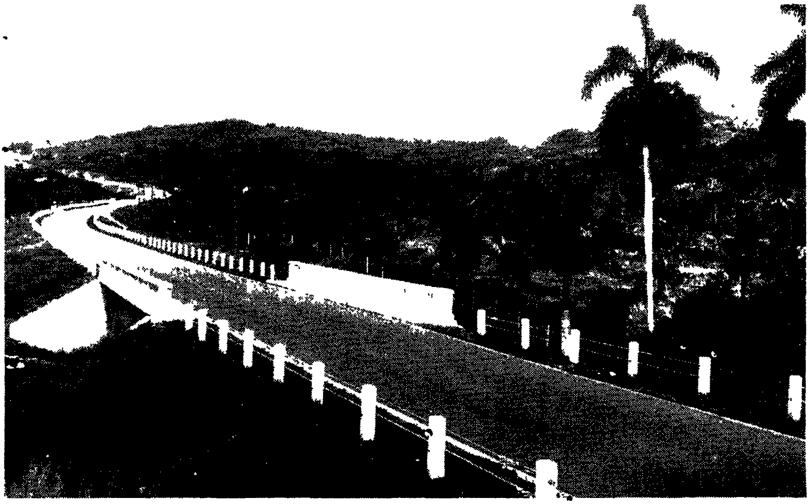

Fig. 290. Typical scene along the Central Highway of Cuba. *Courtesy Cuban Tourist Commission.* When completed, this hard-surfaced road will extend from end to end of the island, a distance of over 700 miles, and will have branch highways connected with the various ports.

In geologic structure the island is complex. Igneous rocks of volcanic nature occupy the uplands, and there are many upturned sedimentary rocks on the slopes and dipping towards the sea. In the valleys coral limestones underlie the soil, which when weathered produce a soil of great fertility. Deposits of copper, silver, gold, platinum, iron, salt, coal, and petroleum are found, but the mining industry is undeveloped.

The political history of Hispaniola has been turbulent. Though the Spanish at first made it the center of their operations in the New World, established plantations, and enslaved Indians and the African Negro, the lure of precious metals on the American mainland resulted in the decline of settlements in the island. Slaves were abandoned or escaped to the interior, mixed with Indians and some whites, and increased in numbers. In 1677 the Spanish lost the island to the French, who rejuvenated plantation agriculture and imported more slaves from Africa. The suitability of the land for such tropical crops as sugar, cotton, tobacco, and coffee has always been an attraction. In the French Revolution of 1791 the slaves rebelled, and under their great black leader, Toussaint L'Ouverture, drove out the whites, and took over the rule of the island as Haitians. Civil wars and much bloodshed were the rule, till in 1844 the eastern two-thirds of the island rebelled from Haiti, and as the Dominican Republic set out on a period of revolutions of its own. Thus were born the Republic of Haiti and the Dominican Republic. Civil wars and revolutions, complicated by investment of foreign capital in plantation agriculture, continued till in 1915 and 1916 the public debts were so great that both republics went into receivership under the protection of the United States. These receiverships have since been withdrawn, and today each is a republic with a constitution and has a president elected by its own people.

Because of the nature of the past history of Hispaniola, as has been stated, the population is composed of a large percentage of Negroes. In Haiti the Negro element is dominant, but in the Dominican Republic the population is composed of whites and mulattos, and 19 per cent Negroes. Haiti has 50 per cent more people than the Dominican Republic, though it is but half as large. The less dense population thus accounts for the fact that the Dominican Republic opened some of its land to settlement by European refugees, the first contingent of which arrived in May, 1940. It is estimated that this republic could support eight times its present population. The United States has done much since about 1925 in encouraging road building, providing sanitation for cities, and establishing schools. However, much remains to be done along these lines. For the island as a whole, illiteracy was about 85 per cent in 1940. The ease of making an agricultural living in this warm land is not conducive to an industrial development.

The resource of lumber is great, for the island remains about 75 per cent forested. Lack of roads prevents its development. In 1950 over half the foreign trade of the island was with the United States. Sugar, coffee, cacao, tobacco, and sisal are the chief crops, and there are possibilities of greatly increased production in all of them.

Puerto Rico

Physical Setting. Puerto Rico, over which the United States flag has waved since 1898, is, in the words of one writer, "one of the lovliest of all those regions of loveliness which are washed by the Caribbean Sea." It is a tropical island, wet on the slopes up which the *Trade Winds* blow, and so dry on the level lands and lee slopes that irrigation is necessary to get good returns from the land. Ocean winds, which are drying on most parts of the island, give low sensible temperatures and reduce the daily and annual maxima that would naturally occur on a land at this latitude. The monthly means rarely vary more than 6° during the year, and the extreme range is only about 40°. The high interior is cooler than the coasts. With the exception of the tropical hurricanes that may come between July and October, the island is a delightful home for its 2,150,000 inhabitants. The Spaniards who made the first settlement in 1509 found the moister parts of the island heavily wooded, many of the trees being of commercial value. Besides mahogany, cedar, ebony, logwood, and sandalwood, there are 28 medicinal plants, 8 plants that furnish resins, 12 that furnish condiments, and an equal number from which dyes and tannin may be obtained. During the 300 years that Puerto Rico was a penal colony for Spain, the forests remained almost intact. But about 1815, when colonists were allowed to take up land and with their slaves made preparations for sugar plantations, the forests were destroyed in the moist plains on the north side of the island. The exploitation and destruction of the forests have gone on apace, until little of the original stand is left.

In geologic structure the island is simple. There is a base of igneous rock that outcrops in the higher parts, and, resting on this on both north and south, are inclined beds of limestone that dip toward the sea. In harmony with the simplicity of the geology, there are few minerals, practically all coming from the igneous rocks. Gold was easily found in the stream beds by the Spaniards, but in small quantities; cinnabar occurs in some sections; and there are some deposits of iron ore. The building stones are few in variety.

Effects of United States Control. During the long period that the island was under Spanish control, there was peace and prosperity but little progress. The better class of Spanish Creoles were satisfied with the rule of the Spanish Crown, and in the history of Puerto Rico there are few uprisings against the mother country. Possibly the futility of such disorder deterred the leaders, as the small size of the island reduces the chances for a successful revolution. The peasant class of Creoles was peaceable, indolent, unschooled, yet intelligent. They lived a quiet, simple life on their small patches of land. Their tools were primitive, and their methods were simple. The Negro first came as a slave, and after his emancipation remained to form a lower stratum of society. About 25 per cent of the population of the island is colored, consisting for the most part of mulattos. The great dominance of white blood among the people (75 per cent) is probably the chief reason for the rapid progress that has been made since the United States occupation.

With United States control came United States capital to be invested in sugar lands, coffee, tobacco, and banana plantations. Puerto Rican products now entered United States markets free of duty, and there was ushered in an era of prosperity. Only a small percentage of the people are engaged in the manufacturing industries, which includes the preparation of sugar, coffee, and tobacco for market and the making of soap, matches, furniture, vehicles, and machinery.

The greatest work of the United States has been done in the building of roads and railroads, in the improvement of sanitary conditions, and in the introduction of a practical modern educational system. Still, about 40 per cent of the people are illiterate. The percentage, when United States took over the islands in 1899, was about 80. There are now 1100 miles of roads and 335 miles of railroads. A railroad now encircles the island. There are common schools, high schools, manual training schools, agricultural schools, and a university.

Although there has been some agitation on the part of some of the Puerto Rican politicians for independence, the vast majority of the people are satisfied with United States control. Since the island forms a territory of the United States, its products enter United States markets free of tariff duties. This privilege probably would be withdrawn if independence were granted—a fact the advocates of independence frequently do not consider.

THE CANAL ZONE AND PANAMA CANAL

The Spanish-American War, begun in 1898, showed the people of the United States the great need of a canal across the isthmus connecting North and South America. They realized then, as never before, that a water route through this isthmus would enable them to protect their coasts with a much smaller navy, for vessels could be shifted readily from either coast to the other. Growing foreign commerce and repaid industrial development also called for a shorter water route to the Pacific.

Just after the settlement of the Oregon Question and the acquisition of California, the United States, seeing the need of bringing the Pacific Coast into closer touch with the eastern part of the country, made a treaty with Colombia, in 1846, obtaining the right to a transit route for a road, railroad, or canal across the isthmus. But the urge was not sufficient to lead to action, even though there was much traffic across the isthmus after the discovery of gold in California in 1848, and the right was allowed to lapse. When the urge to action came and investigations as to the most feasible route were completed, new treaties, this time with Panama, in 1904, had to be made for a lease on the Canal Zone and a right-of-way for a canal in this zone. In the meantime the French had attempted to excavate a canal but had failed through lack of funds and inability to cope with tropical diseases. By 1904 medical science had discovered many ways of controlling tropical fevers, a development of great importance to the United States in the Canal Zone.

Construction on the United States Panama Canal was begun in 1904, and the first boat passed from ocean to ocean on August 15, 1914. The great task of linking the Atlantic with the Pacific was completed in a little more than 10 years and 3 months, at a total cost of about $375,000,000.

The United States met and solved the same problems that had confronted the French. The floods of the Chagres River are regulated by a huge dam at Gatun, 7500 feet long, and 2100 feet wide at its greatest width, with a spillway 1.5 miles long, over which the flood waters flow after they have reached a sufficient height. A large "pool," Gatun Lake, is formed above the dam. Into this lake the water of the undrowned portions of the Chagres River flows, and across this lake, by means of embankments, the Panama Railroad is carried. The canal, for nearly a third of the distance across the isthmus, passes through this lake, excavations having been necessary at some places to give sufficient depth. Some of the water of the Chagres River is used for the operation of the canal. Gatun Lake, therefore, takes care of the excess water and at the same time furnishes water for the locks and eliminates the trouble arising from the crossing of the river channel and the canal.

The mountain ridge that forms the backbone of the isthmus is passed by a huge cut, called the Culebra (now Gaillard) Cut, nearly 500 feet deep and 7 miles long. The amount of excavation necessary to pass the mountain range was materially reduced by the use of locks. There are three double locks at Gatun, by which the largest ocean vessels are locked up from the Atlantic Ocean level to the level of Gatun Lake, 85 feet above the sea; and on the Pacific side of the isthmus there is one double lock at Pedro Miguel, and two double ones at Miraflores, by means of which vessels passing to the Pacific are lowered 85 feet to the Pacific level. The minimum depth of the canal is 41 feet; the width of the lock chambers is 110 feet, and the length 1000 feet, thus accommodating most of the largest ocean vessels.

On September 23, 1915, after the canal had been in operation a little more than a year, slides occurred on the sides of the Gaillard Cut after a heavy rain, and great masses of earth were pushed up from the bottom of the canal, nearly closing the channel. An examination showed that the angle of the slope of the cut was too steep for the earth to remain at rest under all conditions, and that the soft nature of the material in the hill and its great weight had resulted in the earth in the bottom of the cut being forced upward. Dredges were soon at work removing the obstruction. The canal remained closed to traffic until April of the following year. Since that time the slopes of the cut have been greatly reduced, and the hill lowered.

Another great problem that had to be solved was the most important of all and the one that really caused the failure of the French, as previously stated; this was the control of diseases. Forests were cut, undergrowth was removed, swamps were drained, a good source of domestic water was provided, buildings were thoroughly screened, and the garbage and sewage were properly disposed of. These measures made the Canal Zone cities and camps as sanitary and as healthful as most United States cities. It was even boasted that the death rate in Colon and Panama was lower than that in any United States city; but these low figures were due to the fact that many of the sick persons were removed from the zone before death occurred.

Many benefits accrued to the United States from the building of the Panama Canal. The journey across the isthmus by ship, if no delays are met with, takes from 7 to 8 hours, the record time being 4 hours and 10 minutes. The maximum capacity is about 17,000 ships a year. Without the canal, ships would have to sail southward the whole length of South America around the "Horn," or through the dangerous Strait of Magellan, and north along the west coast. Between New Orleans and San Francisco the Panama Canal saves vessels 8870 miles, or about 28 days of time. To Valparaiso from New Orleans, the saving is 4750 miles. San Francisco is nearer New York by 7870 miles; Yokohama, Japan, nearer by 3678 miles; and Hawaii, by 5280 miles. By the canal, Japan is 1800 miles nearer New York than Liverpool; Shanghai is nearer New York by 1600 miles; and Sydney, Australia, by 2400 miles. These shorter distances tend to reduce the importance of British entrepôts and greatly aid in the establishment of direct lines of steamers between New York and the Orient. Formerly, the west coast of South America was about as near to London as it was to New York by steamer. Now it can be reached from New York by sailing almost directly south.

New Orleans is more than 2600 miles nearer Callao than Liverpool is. The west coast of South America, like the Caribbean lands, is, distance considered, definitely within the commercial sphere of the United States. Vessels are now able to sail around the continent of South America and are not forced to retrace their route, as they formerly did. The western coast of the United States has cheaper freight rates than before, on goods to or from the eastern states.

But the Panama Canal is an expensive project. The original cost was approximately $375,000,000, and interest on the investment at 4 per cent has been about $15,000,000 annually. Much additional expense for upkeep and fortifications has been necessary. The total annual tonnage has been below 30,000,000 long tons most of the time, bringing an income of about $18,000,0000. However, the dollars and cents value of the canal is not a true measure of its worth. The influence of lower freight rates, particularly for our west coast lands, and the opening of such lands to markets, together with the military importance of the canal to the United States, must be considered. Many of the Rocky Mountain states are commrecially tributary to the western coast of the United States, whereas before the completion of the canal they had a tendency to look toward the East for most of their commercial dealings. The Gulf Coast of the United States has been benefited. Railroad lines extending north and south have increased their traffic greatly, and now draw much business from the Middle West that formerly went to New York. A saving of time means lower freight rates and cheaper products to the consumer.

The Canal Zone has an area of nearly 554 square miles, 5 miles wide on either side of the center of the canal, and some 40 miles long from deep water in the Caribbean to deep water on the Pacific Coast. In addition there are lands that are flooded by Gatun Lake, and lands for fortifications and for future dams that might be needed to maintain the water level of the lake in dry seasons.

The zone is virtually a government reservation in which private individuals are not permitted to own real estate, but the land may be leased for agriculture and also for building sites for enterprises engaged in businesses related to the chief functions of the canal, and interocean movement of ships engaged in commerce. The canal was conceived and constructed as a strategic venture, and most of the cost has been assumed by the War Department, but its function so far, at least has been largely commercial.

THE VIRGIN ISLANDS

The three small islands, St. Thomas, St. Croix, and St. John, of the Virgin Island group, were purchased by the United States from Denmark in 1917 for $25,000,000. The total area is 132 square miles (the cost, therefore, was nearly $300 an acre), only a part of which is of any agricultural value, because the islands are merely tops of mountains, and only a part of the upper slopes is level enough for cultivation. The strategic position of the islands, near the ocean route between North and South America, their location near the Anegada Passage—much used by ocean traffic—and the excellence of the harbor of St. Thomas on St.

Thomas Island were the chief considerations in their purchase. On two previous occasions the United States had begun negotiations with Denmark relative to the purchase of these islands, but the attempts had failed although both times the people of the islands had expressed their willingness to change flags. The possibility of Germany's securing them and thus getting a footing in the New World and challenging the Monroe Doctrine was the immediate cause of purchase. Already Germany had secured important harbor privileges at St. Thomas.

The islands had been a financial burden to the Danish government, having had, like the other colonies of European nations in the West Indies, economic reverses. The people welcomed the change in ownership, expecting that American control would bring prosperity to them as it had to Puerto Rico; but they have not received much attention beyond the opening of United States markets to their products, which consist of sugar, molasses, hides, and bay rum. The total population of 30,000 in 1947 was about 80 per cent Negro. Administrative officers for the islands are appointed by the United States Navy.

QUESTIONS, EXERCISES, AND PROBLEMS

1 What European nations possess colonies in Middle America? List the colonies belonging to each. Of what commercial value are they to these countries? Get the data on exports and imports and types of articles entering into commerce. To what extent do these colonies trade with the United States?

2 Rank the different political divisions of Middle America in area, population, illiteracy, miles of railroad, exports, imports, and any other data furnished in the *Statesman's Yearbook*. Has material progress been greater in independent countries or in the colonies? What is one of the reasons for the high rank Cuba holds among the independent countries? Rank the countries of Central America. Which one is lowest? How do you explain the difference? Is it environment or man?

3. At the present time the Cuban government is encouraging diversification of crops in Cuba. What are the reasons? How would diversification be a benefit?

4. Make a special study in comparing and contrasting Jamaica and Puerto Rico in size, population, products, industries, and general status of the people. How do you account for what you find?

5. What prompted the United States to construct the Panama Canal? In what ways have the United States benefited by its construction?

6. With what countries does Cuba have commercial relations? Does proximity to the United States have any bearing on the trade relations of Cuba? What other factors may affect the extent of our commerce with Cuba?

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